CIRCULATES IN EVERY PROVINCE IN CANADA.

CANADIAN MACHINERY AND MANUFACTURING NEWS

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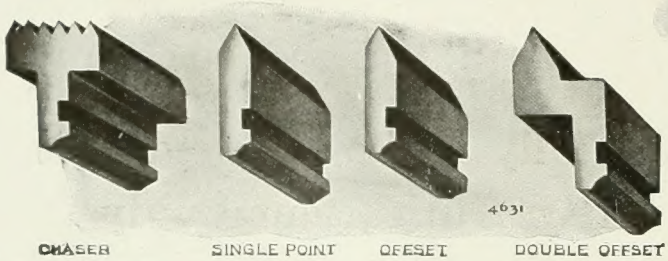

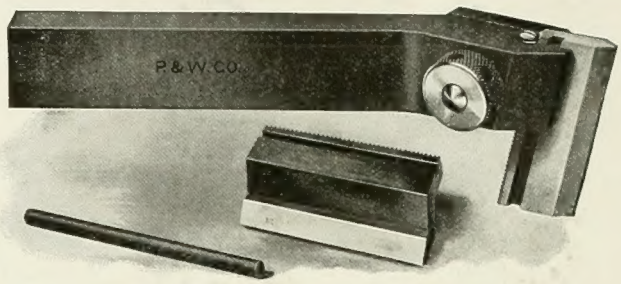

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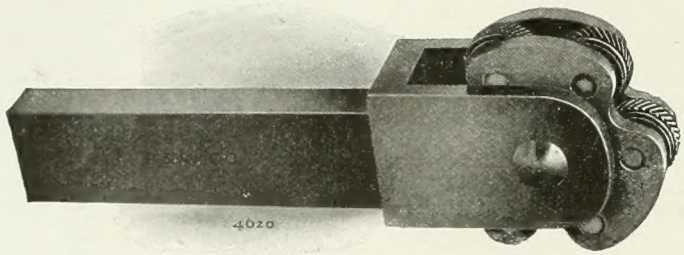

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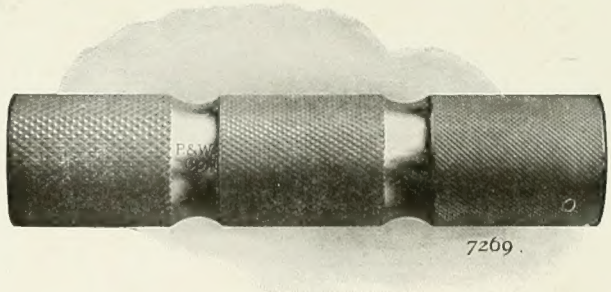

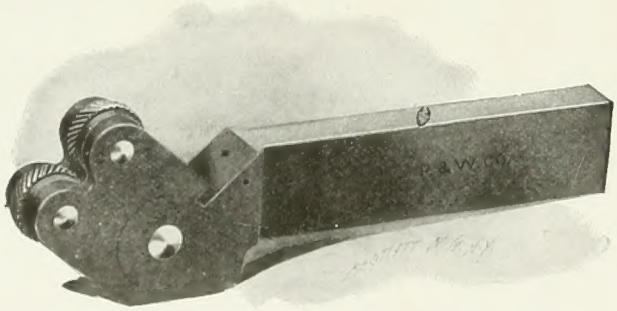

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The Publisher's Page

By B.G.N.

PUBLICITY AS A BUSINESS ALLY

You as a manufacturer have particular interest in Canadian Machinery because it represents you and reaches your sales prospects. It should have your interest because it represents your interests.

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The Relation Between Production and Cost Compared*

By H. L. Gantt

It has been common practice to make the product of a factory running at part capacity to bear the whole expense. This is recognized by many as illogical, although no rational theory as to what proportion of expense such product should bear has been advanced.

MANUFACTURERS in general recognize the vital importance of a knowledge of the cost of their product, yet but few of them have a cost system on which they are willing to rely under all conditions.

While it is possible to get quite accurately the amount of material and labor used directly in the production of an article, and several systems have been devised which accomplish this result, there does not yet seem to have been devised any system of distributing that portion of the expense known variously as indirect expense, burden or overhead, in such a manner as to make us have any real confidence that it has been done properly.

Indirect Expense Distribution.

There are in common use several methods of distributing this expense. One is to distribute the total indirect expense, including interest, taxes, insurance, etc., according to the direct labor. Another is to distribute a portion of this expense according to direct labor, and a portion according to machine hours. Other methods distribute a certain amount of this expense on the material used, etc. Most of these methods contemplate the distribution of all of the indirect expense of the manufacturing plant, however much it may be, on the output produced, no matter how small it is.

If the factory is running at its full or normal capacity, this item of indirect expense per unit of product is usually small. If the factory is running at only a fraction of its capacity, say one-half, and turning out only one-half of its normal product, there is but little change in the total amount of this indirect expense, all of which must now be distributed over half as much product as previously, each unit of product thereby being obliged to bear approximately twice as much expense as previously.

When times are good, and there is plenty of business, this method of accounting indicates that our costs are low; but when times become bad and business is slack, it indicates high costs due to the increased proportion of burden each unit has to bear. During good times, when there is a demand for all the product we can make, it is usually sold at a high price and the element of cost is not seen an important factor. When business is dull, however, we cannot get such a high price for our product, and the question of how low a price we can afford to sell the product at is of vital importance. Our cost systems, as generally operated at present, show under such conditions that our costs are high, and if business is very bad, they usually show us a cost far greater than the amount we can get for the goods. In other words, our present systems of cost accounting go to pieces when they are most needed. This being the case, many of us have felt for a long time that there was something radically wrong with the present theories on the subject.

As an illustration, I may cite a case which recently came to my attention. A man found that his cost on a certain article was 30 cents. When he found that he could buy it for 26 cents, he gave orders to stop manufacturing and to buy it, saying he did not understand how his competitor could sell at that price. He seemed to realize that there was a flaw somewhere, but he could not locate it. I then asked him what his expense consisted of. His reply was labor 10 cents, material 8 cents, and overhead 12 cents. My next question was:—Are you running your factory at full capacity? and got the reply that he was running it at less than half its capacity, possibly at one-third. The next question was: What would be the overhead on this article if your factory were running full? The reply was that it would be about 5 cents; hence the cost would be only 23 cents. The possibility that his competitor was running his factory full suggested itself at once as an explanation.

The next question that suggested itself was how the 12 cents overhead, which was charged to this article, would be paid if the article was bought. The obvious answer was that it would have to be distributed over the product still being made, and would thereby increase its cost. In such a case it would probably be found that some other article was costing more than it could be bought for; and, if the same policy were pursued, the second article should be bought, which would cause the remaining product to bear a still higher expense rate. If this policy were carried to its logical conclusion, the manufacturer would be buying everything before long, and be obliged to give up manufacturing entirely. The illustration which I have cited is not an isolated case, but is representative of the problems before a large class of manufacturers, who believe that all of the expense, however large, must be carried by the output produced, however small.

This theory of expense distribution is quite widespread, and clearly indicates a policy, which in dull times would, if followed logically, put many of our manufacturers out of business. In 1897 the plant of which I was superintendent was put out of business by just this kind of logic. It never started up again.

Fortunately for the country, our people as a whole will finally discard theories which conflict with common sense; and, when their cost figures indicate an absurd conclusion, most of them will repudiate the figures. A cost system, however, which fails us when we need it most, is of but little value and it is imperative for us to devise a theory of costs that will not fail us.

Systems Devised by Accountants.

Most of the cost systems in use, and the theories on which they are based, have been devised by accountants for the benefit of financiers, whose aim has been to criticize the factory and to make it responsible for all the shortcomings of the business. In this they have succeeded admirably, largely because the methods used are not so devised as to enable the superintendent to present his side of the case.

Our theory of cost keeping is that one of its prime functions is to enable the superintendent to know whether or not he is doing the work he is responsible for as economically as possible, when function is ignored in the majority of the cost systems now in general use. Many accountants, who make an attempt to show it, are so long in getting their figures in shape that they are practically worthless for the purpose intended, the possibility of using them having passed. In order to get a correct view of the subject we must look at the matter from a different and broader standpoint. The following illustration seems to put the subject in its true light:—

Let us suppose that a manufacturer owns three identical plants, of an economical operating size, manufacturing the same article, — one located in Albany, one in Buffalo, and one in Chicago,—and that they are all running at their normal capacity and managed equally well. The amount of indirect expense per unit of

*From a paper read at the Spring Meeting, American Society of Mechanical Engineers.

product would be substantially the same in each of these factories, as would be the total cost. Now suppose that business suddenly falls off to one-third of its previous amount and that the manufacturer shuts down the plants in Albany and Buffalo, and continues to run the one in Chicago exactly as it has been run before. The product from the Chicago plant would have the same cost that it previously had, but the expense of carrying two idle factories might be so great as to take all the profits out of the business; in other words, the profit made from the Chicago plant might be offset entirely by the loss made by the Albany and Buffalo plants. If these plants, instead of being in different cities, were located in the same city, a similar condition might also exist in which the expense of the two idle plants would be such a drain on the business that they would offset the profit made in the going plant.

Size of Plant.

Instead of considering these three factories to be in different parts of one city, they might be considered as being within the same yard, which would not change the conditions. Finally, we might consider that the walls between these factories were taken down and that the three factories were turned into one plant, the output of which had been reduced to one-third of its normal volume. Arguing as before it would be proper to charge to this product only one-third of the indirect expense charged when the factory was running full.

If the above argument is correct we may state the following general principle: THE INDIRECT EXPENSE CHARGEABLE TO THE OUTPUT OF A FACTORY BEARS THE SAME RATIO TO THE INDIRECT EXPENSE NECESSARY TO RUN THE FACTORY AT NORMAL CAPACITY, AS THE OUTPUT IN QUESTION BEARS TO THE NORMAL OUTPUT OF THE FACTORY.

This theory of expense distribution, which was forced upon us by the abrupt change in conditions brought on by the war, explains many things which were inexplicable under the older theory, and gives the manufacturer uniform costs as long as the methods of manufacture do not change. Under this method of distributing expense there will be a certain amount of undistributed expense remaining whenever the factory runs below its normal capacity. A careful consideration of this item will show that it is not chargeable to the product made, but is a business expense incurred on account of our maintaining a certain portion of the factory idle, and chargeable to profit and loss. Many manufacturers have made money in a small plant, then built a large plant and lost money for years afterwards, without quite understanding how it happened. This method of figuring gives a clear explanation of that fact and warns us to do everything possible to increase the efficiency of the plant we have, rather than to increase its size.

This theory seems to give a satisfactory answer to all the questions of cost that I have been able to apply it to, and during the past few months I have laid it before a great many capable business men and accountants. Some admitted that this viewpoint would produce a very radical change in their business policy, and are already preparing to carry out the new policy. It explains clearly why some of our large combinations of manufacturing plants have not been as successful as was anticipated, and why the small, but newer plant, is able to compete successfully and make money, while the combinations are only just holding their own.

The idea so prevalent a few years ago, that in the industrial world money is the most powerful factor, and that if we only had enough money, nothing else would matter very much, is beginning to lose its force, for it is becoming clear that the size of a business is not so important as the policy by which it directed. If we base our policy on the idea that the cost of an article can only legitimately include the expense necessarily incurred either directly or indirectly in producing it, we shall find that our costs are much lower than we thought, and that we can do many things which under the old method of figuring appeared suicidal.

Common Acceptation of Cost.

The view of costs so largely held, namely, that the product of a factory, however small, must bear the total expense, however large, is responsible for much of the confusion about costs and hence leads to unsound business policies. If we accept the view that the article produced shall bear only that portion of the indirect expense needed to produce it, our costs will not only become lower, but relatively far more constant, for the most variable factor in the cost of an article under the usual system of accounting has been the "overhead," which has varied almost inversely as the amount of the product. This item becomes substantially constant if the "overhead" is figured on the normal capacity of the plant. Of course a method of accounting does not diminish the expense, but it may show us where the expense properly belongs, and give us a more correct understanding of our business.

In our illustration of the three factories, the cost in the Chicago factory remained constant, but the expense of supporting the Buffalo and Albany factories in idleness was a charge against the business, and properly chargeable to profit and loss. If we had loaded this expense on the product of the Chicago factory, the cost of the product would probably have been so great as to have prevented our selling it, and the total loss would have been greater still.

When the factories are distinctly separate, few people make such a mistake, but where a single factory is three times as large as is needed for the output, the error is frequently made, with results that are just as misleading. As a matter of fact it seems that the attempt to make a product bear the expense of plant not needed for its production is one of the most serious defects in our industrial system to-day, and farther reaching than the differences between employers and employees.

The problem that faces us is then first to find just what plant, or part of a plant, is needed to produce a given output, and to determine the "overhead" expense on operating that plant or portion of a plant. This is primarily the work of the manufacturer, or engineer, and only secondarily that of the accountant, who must, as far as costs are concerned, be the servant of the superintendent. In the past, in almost all cost systems the amount of "overhead" to be charged to the product, when it did not include all the "overhead," was more or less a matter of judgment. According to the theory now presented, it is not a matter of judgment, but can be determined with an accuracy depending upon the knowledge the manufacturer has of the business. Following this line of thought it should be possible for a manufacturer to calculate just what plant and equipment he ought to have, and what the staff of officers and workmen should be to turn out a given profit. If this can be correctly done, the exact cost of a product can be predicted. Such a problem cannot be solved by a cost accountant of the usual type, but is primarily a problem for an engineer, whose knowledge of materials and processes is essential for its solution.

Functions of a Cost System.

Having made an attempt to solve a problem of this type, one of the most important functions we need a cost system to perform, is to keep the superintendent continually advised as to how nearly he is realizing the ideal set, and to point out where the shortcomings are. Many of us are accustomed to this viewpoint when we are treating individual operations singly, but few have as yet made an attempt to consider that this idea might be applied to a plant as a whole, except when the processes of manufacture are simple and the products few in number. When, howver, the pro-

cesses become numerous or complicated, the necessity for such a check becomes more urgent, and the cost keeper who performs this function becomes an integral part of the manufacturing system, and acts for the superintendent, as an inspector, who keeps him advised at all times of the quality of his own work.

This conception of the duties of a cost keeper does not at all interfere with his supplying the financier with the information he needs, but insures that information shall be correct, for the cost keeper is continually making a comparison for the benefit of the superintendent, of what has been done with what should have been done. Costs are valuable only as comparisons, and comparisons are of little value unless we have a standard, which it is the function of the engineer to set.

Lack of reliable cost methods has, in the past, been responsible for much of the uncertainty so prevalent in our industrial policies; but with a definite and reliable cost method, which enables us to differentiate between what is lost in manufacturing and what is lost in business, it will usually become easy to define clearly the proper business policy.

TRADE OPPORTUNITIES IN THE ARGENTINE REPUBLIC.

THE Argentine Republic representative of the Department of Trade and Commerce, Ottawa, deals in a recent report with the following trade opportunities which may be made more or less available:

Tools.

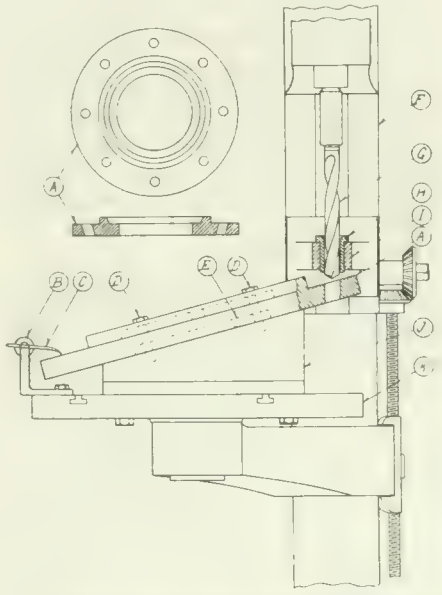
Tools, such as axes, carpenters' tools, taps and dies, spanners, etc., have been imported from the United Kingdom, United States, Germany and France, and in axes and certain classes of carpenters' tools some well-known United States manufacturers are doing a considerable export business. In hand-saws, a very well-known United States make has a strong position, but there is reason to believe that a Canadian-made article of equal price and quality would eventually be able to compete against it. Carpenters' hammers have heretofore been purchased to a very large extent in the northern part of France, and in Alsace. Although this area is included in the war zone, the stocks in hand prevented any shortage being felt, but as they are doubtless becoming depleted, this state of affairs will probably change.

Bolts, Nuts, Screws, Etc.

In Carriage bolts, a Buffalo company practically controls the market, and United States screw companies have a large control of the market in wood screws; in fact, one of these companies has been successful in overcoming the competition of a well-known Birmingham firm, as well as a manufacturer in France. One firm sends the screws wrapped up in small paper packets, tied with string, and another puts them up in neat folding card-board boxes. One large firm stated that three hundred different sizes of screws had to be kept in stock, and for that reason, packing becomes very important. Flat-headed screws are the ones more generally used.

Valves.

English manufacturers have in the past controlled the trade in valves, but owing to the dislocation of business, it will probably be difficult for them to hold it. Canadian manufacturers of valves have an excellent opportunity to extend their sales, as this class of goods is always more or less in demand. A local firm stated that they had been endeavoring to form connections in Canada, but the manufacturer, whom they approached, refused to extend any terms of credit to this market. This seems unfortunate, especially in this instance, as the firm's clients are houses of good standing.



JIG FOR DRILLING ANGULAR HOLES.

Split Wood Pulleys.

Split wood pulleys, although imported into Argentina, are also manufactured in the country.

Metal Goods.

There has been a strong demand for metal lathing, but owing to the present dislocation of the building trade, this has almost entirely ceased, except for those buildings which are being completed. This demand, however, will probably appear again when times become more prosperous. Canadian manufacturers therefore should not wait until prosperity sets in, but should now form their connections so that they may be ready to take advantage of the improvement in business whenever this may occur. The Canadian product seems to be able to compete with that of any other country.

The same cannot be said of metal ceilings and stamped metal work manufactured in the United States, which, owing perhaps to the greater output, seems to be able to underbid Canadian prices.

Metal tiles, which are used in Canada do not meet with acceptance here, as they require wooden sheathing beneath them, without which they would be penetrated by hail. The necessity for the sheathing constantly renders the price prohibitive.

There should be some sale for metal culverts, although at the present time there is not much demand for them.

DRILLING ANGULAR HOLES.

By R. Garth.

THE illustration shows a jig for drilling the holes in the piece A at an angle with the base. The piece J is secured to the drill table K; the upper surface—which is turned to the required angle, having a boss to fit the bore of A, which is secured to the piece J in the desired position.

Secured to the drill press upright F is the piece I, which carries the hardened drill bush H, through which the drill G is fed to the work. The piece I is adjustable in a vertical position and always maintains the drill bush H in a central position relative to the drill spindle. By releasing the clamping bolts D, the work is shifted to the next desired location, which is found by the scriber C.

By using a variety of drill bushes H, the piece I can be used for quite a number of different jobs.

The conditions under which aeroplane guns operate are new to the scientist, and the ordinary trajectory formulæ do not wholly apply, principally because of the altitude from which the gun is fired. Guns fired from the ground attain a long range by means of high muzzle elevation, but the aeroplane gun is fired from a great height and has consequently a much greater range, there being stored in the shot fired from it the potential energy due to the height. Thus, if a 3-in. shot were fired from a height of 10,000 ft., there would be potential energy stored in it of 60,000 foot-pounds and, if fired with the gun barrel horizontal, the range would be considerably over 12,000 yards. The same gun, fired from the surface of the earth would have an extreme range of 2,000 yards only.—Ex.

NEW PROCESS DEVELOPMENTS

Inventive Genius and Research Operate to a Dual End — They Aim to Improve What We Now Possess and Bring to Our Service Commodities Before Unknown

CONCERNING DROP FORGINGS FOR AUTOMOBILES.*

By Arthur Stubbs.

THE number of parts or pieces required has an important bearing on the question as to whether these shall be drop forgings or otherwise. If the number of parts required is very small, say less than 100, it may be better to use a casting or a forging, as the cost of a pattern is less than that of a pair of dies, and reduced first cost may outweigh the other advantages of the drop forging. If, however, a considerable number of similar parts are required, the exact number depending largely on the simplicity or otherwise of the design, and also on the dies, drop forgings should be used, as they will give greater consistency in the metal than a casting, so that machining is easier, while the part can be produced with greater accuracy and more closely to size than either a casting or forging. The machining cost will be less, as there will be less metal to remove, except in the case of such a part as a hub, where a casting could be cored out. A drop forging will also be stronger than a casting of the same weight, or lighter for the same strength.

There is, of course, nothing to choose under this head between drop forgings and hand forgings. It is, perhaps, hardly necessary to point out that the process of cutting from the solid can only be applied to a somewhat limited number of parts of the automobile, and they must be of simple and regular form, but if the cost of the dies is taken as the equivalent of that of the special tools necessary for a particular job, a part may probably be machined from the solid more cheaply than a drop forging can be finished. The forging, however, will be stronger, as the operation of forging makes the metal more homogeneous and improves the structure, while in many pieces the grain of the metal will run in a direction which gives better resistance to the stresses.

Material of Dies.

The dies, which may be taken to correspond to the mould for a casting, are made of a variety of materials, depending upon the class of forging and the number required. Cast iron is now seldom used, except in the case of fairly large and plain parts made in wrought iron or mild steel (soft). Common Bessemer steel blocks are used when the quantity required is small and the article fairly simple and large, so that the material for the forging is not hard to work and the dies need not be hardened. The material most generally used is a high-grade Siemens acid steel, made upon a Swedish base, thus containing some "body," so essential to toughness in dies. A general analysis of such a steel is as follows: Carbon, 0.65 per cent.; manganese, 0.60 per cent.; silicon, 0.045 per cent.; sulphur, .02 per cent.; phosphorus, 0.025 per cent.

Crucible cast steel is used when the article is small and the quantity great, and also when the material for the forging is hard to work, such as a high-carbon or alloy steel. Nickel steels have also been used, generally owing to their greater toughness, but it is only in exceptional cases that the cost of this material is justifiable. It is a good axiom to use the best material possible compatible with the cost, as the risk of breakage due to using a poor quality of steel is great, and the few dollars extra cost per 100 lbs. is unimportant compared with the cost of replacing a broken die.

Life of Dies.

The number of forgings which a pair of dies will make depends upon the quality of the steel used for the blocks, the quality of the steel used for the forgings (that is, whether it is ordinary mild steel, high-carbon steel or an alloy steel), and the design of the article, whether it is simple or one requiring very deep or sharp angular impressions. The life of a die is also largely governed by the amount of metal required to be removed for a single re-cut, though it is very seldom in practice that a pair of dies are really worn out in automobile work, as they can usually outlast the design.

The allowance for fin—that is, the thickness of metal between the top and bottom dies, varies from about ⅛ in. to ¼ in., but, as will readily be appreciated, this depends upon the weight and design of the forging. In many cases the dies must be guttered, so as to allow the waste metal to flow out more easily. This is particularly necessary where the forging has very deep bosses, as dies are very often broken, through the material choking the die owing to the smallness of the outlet or gutter.

In order that the guttering of dies should be fully understood, it may be well to point out that reference is made to something more than the outlet at the end of the die which allows the material to flow out with the tag (the tag being described as the porter-bar, which is welded on to the material being used for the forging). The face of the bottom die is cut away in corrugations so that instead of the die presenting a perfectly flat surface, the actual finishing impression stands up slightly above the face owing to the other part of the die being corrugated. This is very important in the case of forgings which are very liable to choke a die owing to a very deep boss and so on. It also enables the material to flow out evenly in all directions, and, in consequence, the forgings contract more uniformly during cooling.

Production Tolerance.

A drop forging can be produced to a tolerance of 1-32 in. as an ordinary commercial limit for small work, though it is quite possible by careful forging and supplemental re-striking, and provided that the forging is fairly small, to produce work within a few thousandths of an inch of dead size. The degree of accuracy possible in drop forging is, however, very seldom realized, and for work within very fine limits it is absolutely necessary to have multiple dies, that is, one or more pairs of dies for roughing out, and one or more pairs of dies for the finishing operations. It would very often pay to have forgings re-struck, preferably in a pair of finishing dies, especially when the part can be jigged for machining, as the difference in cost between jigging a piece and setting it up separately is very considerable.

Multiple Dies.

In many cases multiple dies are desirable but prohibitive on account of their cost, their use being limited owing to the small number of pieces of any given pattern usually required. A connecting rod made in alloy steel, especially when the rod is to be within a fine weight limit and carefully balanced, may be quoted as an instance where multiple dies would be desirable. Multiple dies are also necessary if it is desired to eliminate the stresses set up in forging, due to large and deep bosses being adjacent to very thin and long webs. The necessity for eliminating sharp corners and angles, and avoiding the design of parts which have deep and very thin sections is urged. It is also very desirable that the designer should work with the drop forger in this matter.

*Paper read before the Institution of Automobile Engineers.

After the dies have been cut and tested for correctness with the lead impression, they are then carefully hardened if they are small, but large dies are not usually hardened owing to the risk of breakage. The necessity for slow and uniform heating of dies for hardening is a very important factor, and quite as much care has to be taken to avoid distortion as in hardening a gear blank. The defects due to rapid heating and sudden quenching are well known, but it may be desirable to point out that this very often results in a broken or badly distorted die, which gives rise to the complaint that the forging is not to shape.

Keeping Dies Cool and Clean.

It is very necessary that, during the process of forging, the face of the die should be kept cold, and this is accomplished by directing a blast of air from a 1-in. to 1½-in. diameter pipe on to the face. It is also necessary to keep the dies clean, which is usually accomplished by using a wire brush. To prevent the work from sticking in the die, oil is used, which is thrown into the top die, as the tup rises, by the use of a swab or stick. After the piece has been finished in the die, the fin has to be removed in a pair of trimming dies, which consist of a bed cut out to the finished shape of the forging, and this forms the bottom die, while a punch, formed to the profile of the forging, forms the top die and presses the forging through the bed, thus leaving the fin around the punch. It is scarcely necessary to point out that the fin is removed by a suitably-geared press.

Steel for Automobiles.

In considering the various classes of steel used in the construction of motor cars, it is curious to notice that in many cases where an automobile manufacturer has found a steel which gives him the minimum of trouble he will specify it for every conceivable part. It is common to find a low-carbon, case-hardening steel actually used for steering levers, or a high-nickel-chrome steel for a connecting rod, while a crank-shaft is made of ordinary 0.30 per cent. carbon steel.

As to who should be actually responsible for the choice of the steel to be used in any particular part of a car, there are three alternatives. The automobile maker may (1)—specify both the maker and the quality of the steel; (2)—tell the steelmaker what he wants and allow him to recommend the quality his experience shows to be the most suitable; or (3)—specify his tests and the purpose for which the part is required, and then ask the drop forger to supply a part to meet that test and hold him responsible.

In the first case the automobile manufacturer assumes responsibility as to the final tests, yet in the event of trouble he blames the drop forger or the steelmaker, or probably both. The steelmaker will claim that the drop forger has spoiled the steel by incorrect treatment, and the drop forger will reply that the steel was unsuitable. If the steelmaker accepts the test specified by the automobile manufacturer and recommends a steel for a particular part, he should be held responsible for the final test, provided the instructions he furnishes have been carried out. So far as bar material is concerned, that is probably quite satisfactory, but, in the case of material to be worked up by the drop forger, it leaves a loophole for the steelmaker to evade responsibility by saying that the drop forger has ruined the steel. This may be true, but the ruin may be caused either by careless treatment in not carrying out the steelmaker's instructions, incorrect treatment due to his ignorance of the properties of the steel, for which the steelmaker is largely responsible, or working a steel which was totally unsuitable for that particular part, and for which the steelmaker is responsible. Abundant evidence is available to prove that the steelmaker is not the best qualified to recommend, in all cases, a steel for any particular part.

If the drop forger accepts the test specified by the automobile manufacturer as being reasonable, he can be held responsible for the finished part, because he has a free hand in the choice of the material he buys and of the maker from whom he buys it; he will confine himself to the use of those steels which his experience tells him are most reliable and with the properties of which he is fully acquainted, and this will tend to a more uniform output.

A PISTON RING FIXTURE.

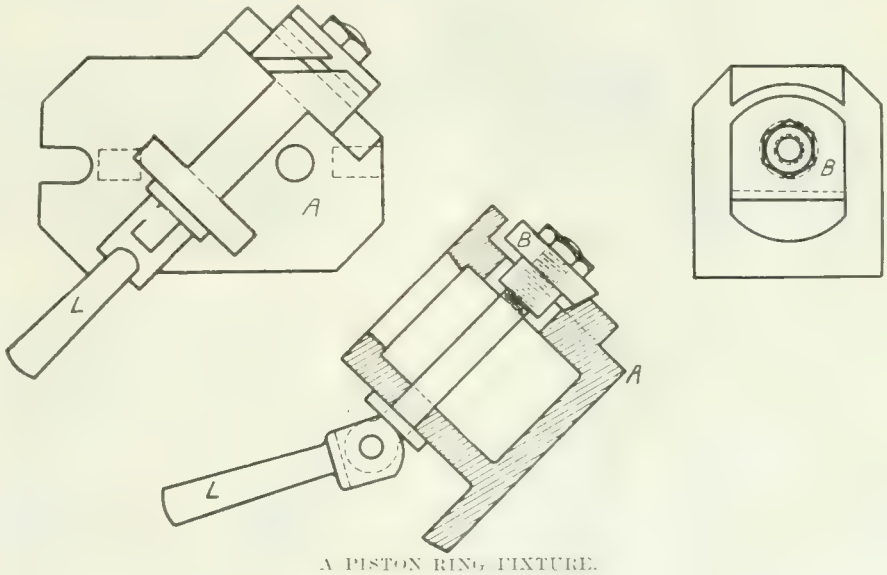
By D. S. Mann.

IN the drawing is shown a fixture for holding piston rings of the smaller sizes while parting same, this being designed particularly for use on the hand-milling machine, although, of course, it is adaptable for the regular machine. The work, however, can be done much more advantageously and cheaply on a hand-fed machine.

The fixture comprises the one main casting A, this being bolted to the machine table, and being provided with lugs for locating in the table slots. The particular rings in this case were split at an angle of 45°, so that the vertical face of the fixture is placed at this angle. The end view and section shows the projecting lug at the top, this being turned to the proper radius for the ring. The latter is held between this lug and the clamping piece B. The clamping piece is cut at a bevel on the bottom, and rests on a corresponding bevel on the main casting; this is operated by means of the cam lever L through the eye bolt.

It will be noticed that the two vertical parts of the main casting are joined by a rib at the top for strength. A heavy spring, not shown in the drawing, is placed around the eye bolt so as to push out the clamping piece B when the cam is released. This cam works on a hardened steel washer. When the cam lever is depressed, the piece B is drawn in, rising on the bevel and clamping the ring which has been placed on the top of same and beneath the projecting lug at the top.

The eye bolt is threaded into the piece B, and is provided with a lock nut, so that adjustments can be quickly made. The cut made by the milling cutter is, of course, carried entirely through the upper part of the frame and lug, and this serves to centre up the cutter.



A PISTON RING FIXTURE.

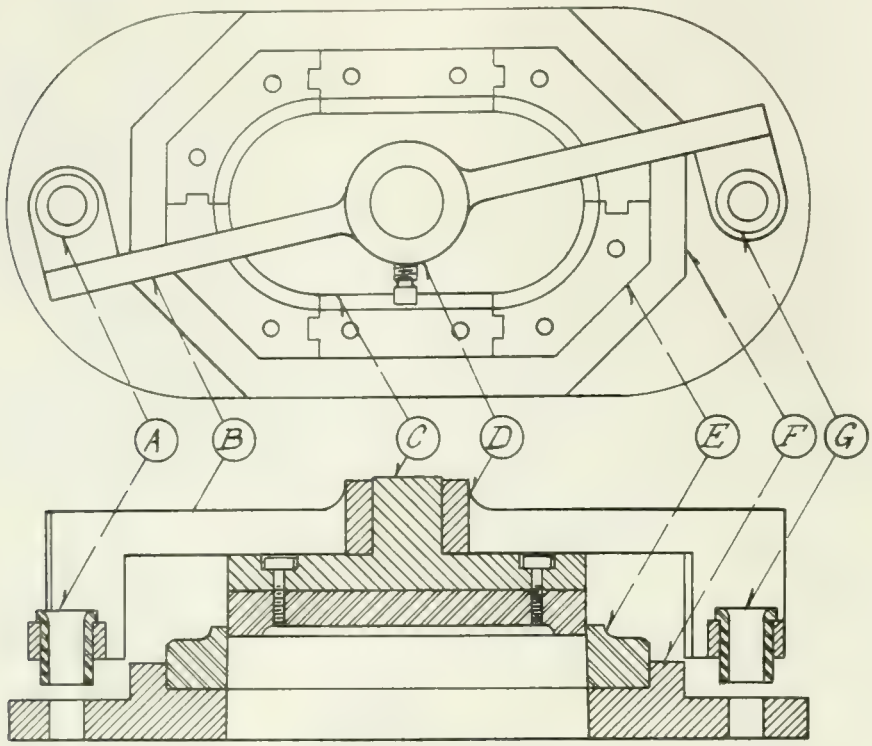
PRODUCTION METHODS AND DEVICES

A Department for the Interchange and Distribution of Shop and Office Data and Ideas Evolved from Actual Practical Application and Experience

DRILL JIG FOR DIE BED.

By G. Hamilton.

THE accompanying sketch shows a useful jig for drilling the clamping holes in dies for the punch press, it being sometimes very unhandy to locate these holes in the proper position, especially when the contour of the die is of an irregular shape.



DRILL JIG FOR DIE BED

The punch C and the die E, being fitted, the jig B is placed upon the shank of the punch holder C, and secured by the set screw shown in the position required. The drilling is performed through the hardened bushes A and G in the usual manner, bringing the holes a certain distance apart, also equidistant from the punch stem and in line with each other.

A FEW MULTIPLE JIGS.

By W. G.

QUITE a number of multiple jigs do not, in actual practice, produce the expected results; this being very often due to one of two things, namely, the locating parts are so enclosed as to render the clearing away of chips a difficult and lengthy operation. Again, the method of holding work is often far too complicated, thus in many cases taking longer to insert and remove the [illegible] to perform the machining operation. It must, of course, be admitted that these conditions cannot always be avoided, but in many cases a little forethought when designing, would mean elimination of the aforementioned troubles.

Slitting Jig.

The drawings herewith illustrate a few jigs of the multiple type that have in actual practice proved in every way satisfactory. Fig. 1 shows three views of a slitting jig. The base, part A, consists of a flat rectangular cast iron plate on the upper face of which is formed a tongue groove A^1 for the purpose of aligning the locating or work block B. This is made from a block of mild steel, the longitudinal sides being shaped away to form the eight vee grooves as shown. The said block is further provided with two transverse holes B^1 for receiving the clamp bolts C. These holes should be quite free to the bolts, as this compensates for any unevenness during clamping. Parts D and E are the clamps; these are preferably made from flat mild steel stock, and therefore require but little machining. It will be noticed that the clamps D are made integral with the studs C by screwing and riveting, while the clamps E are a sliding fit. Parts F are the clamp springs, their object being to keep the clamps in the outward position during insertion and removal of work.

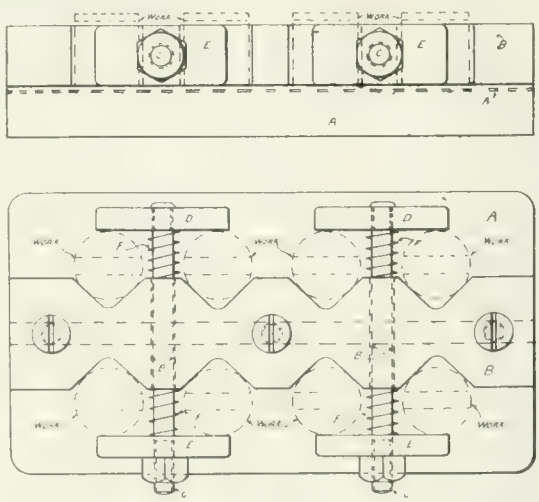
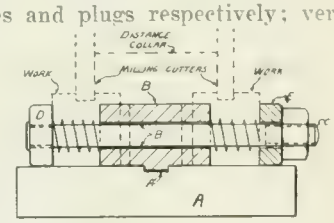


FIG. 1. SLITTING JIG.

Spanner Flats Milling Fixture.

Fig. 2 shows elevation and plan respectively of a fixture used for milling the spanner flats on the end of gland nuts; two settings of the fixture being required to complete the operation. The base G consists of a U-shaped iron casting, provided at its extremities with two feet or projections, G^1 and G^2; the use of which is to secure the base to the machine when in operation. The body H is also made from an iron casting, and consists of a circular disc, on the upper face of which is formed a square block or projection H^1 for carrying the work by means of the holes H^2 as shown. Parts I and J are the mild steel clamping plates and plugs respectively; very little need be said of these, beyond the fact that they (the plugs) should be a free fit in the transverse holes in the



block H^1, likewise the clamp stud K. Parts L are the clamp plate springs, and Part M is the fulcrum plug; this is for locking the body in position when in operation. The enlarged part M^1 should be made a tight fit to the central hole in the body, and the reduced part should be a sliding fit (not loose) to the hole in the base G. Indexing is carried out by means of the hardened plug O engaging with the index block P and the two holes at an angle of 90 dgs. apart formed in the periphery of the body H as shown.

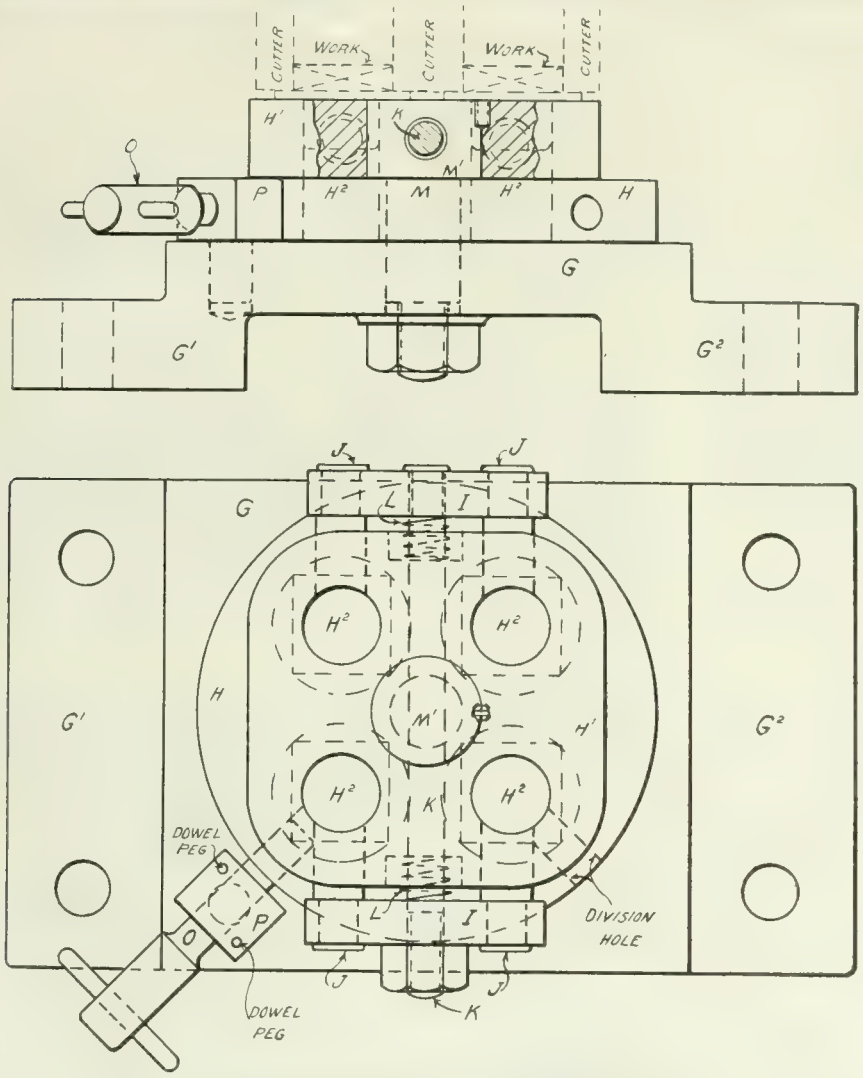


FIG. 2. SPANNER FLATS MILLING FIXTURE.

is next withdrawn, and the index plug removed from the hole in the body H. The locking nut is then slackened off, thus leaving the body free for rotation, until the next hole in its periphery is brought into alignment with the index plug, which is reinserted, and the body locked ready for the next operation (finishing square.)

Key Slot Milling Fixture.

Fig. 3 shows side and end views of a simple fixture for milling key slots in small sliding shafts. The body R consists of a rectangular cast iron block provided at its base with two steps or projections R^1 and R^2, for securing it to the machine table. It is further provided upon its upper face with three vee grooves as shown, for locating the work. Part S is a mild steel thrust plate; it being made to swivel to facilitate cleaning away the chips from the vee grooves. The clamping plate T is also made from mild steel. It is rigidly secured to the body R; its object being to carry the three clamping pins U; these consist of ordinary set screws turned down at the end to receive the mild steel clamping discs V. The object of these latter is to prevent injury to the work when clamping.

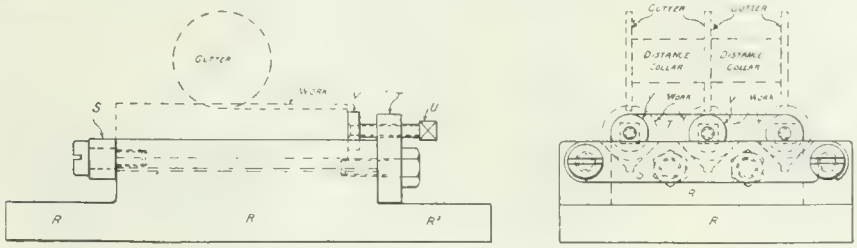


FIG. 3. KEY SLOT MILLING FIXTURE.

The sequence of operations is as follows: The first cut produces parallel flats on the sides of the work; the fixture

It may be worthy of mention that in this particular case it was advantageous to use a separate clamping means for each part, as the overall lengths of the shafts were not particular within 3-32 in., yet it was essential that the length of keyslot from the plain end (uncut) should in each case correspond with the other. This latter was made possible by locating against the face of the thrust plate S by means of the set screws as shown.

THE IMPORTANCE OF CORRECT GATING.

By Arthur Smith.

IT is perhaps not an exaggeration to state that fully fifty per cent. of the castings proving defective in a foundry are the result, either directly or indirectly, of incorrect gating. A careful and efficient foreman will see that the moulders are provided with proper equipment in the way of flasks; he will insist upon the necessary sands and facings, and will insure that the mould is fully secured and vented, but will leave the location and size of the gates to the judgment of the mechanic.

Correct gating is an art, and it is unfortunate that so few moulders value it at its true worth. We are all aware that if any dirt at all ocurs in a casting it will likely be found at or near the gate. Still, many mechanics will place the gate right against or upon a finished face, simply because it offers a convenient place for the metal to enter the casting. Another delusion is that a heavy casting must have large gates, sight apparently being lost of the fact that several small gates will fill the casting equally fast, while the runner box may be kept full at all times and the danger of slag and dirt going down materially reduced.

Top or "Pop" Gate.

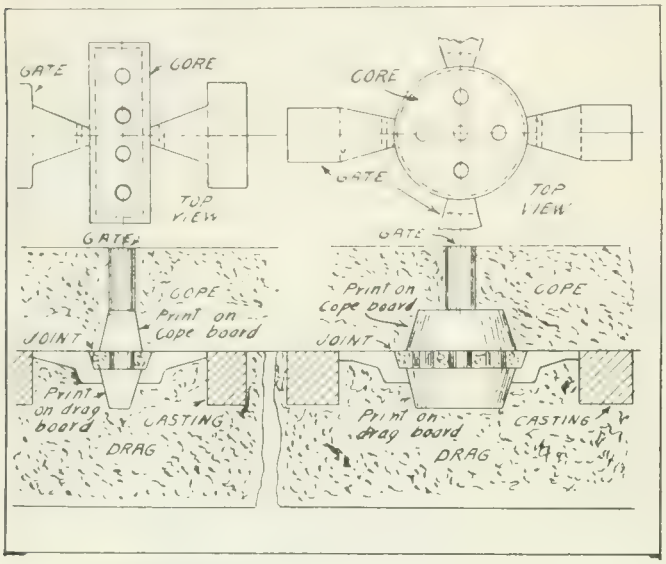
Many moulders lean toward the top or "pop" gate. This is a round gate, 3/8 in. or 1/2 in. in diameter, placed directly on top of the casting, and in a great many cases it is a first-class arrangement. One of the principal objections to its general use, however, is that the metal falls continuously upon the face

of the mould or core, and is apt to cause cutting or scabbing unless the mould is nailed where the metal strikes. In castings having flanges or pockets where a

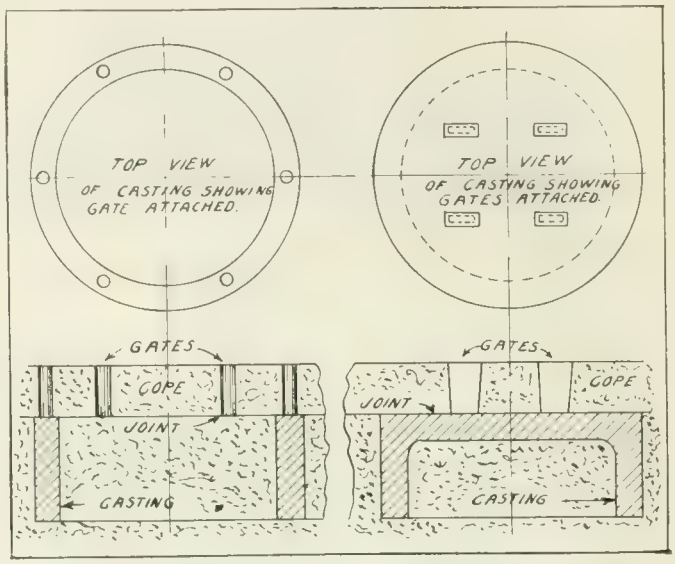
The "Strainer" Gate.

The "strainer" gate for small gated work is one of the most satisfactory that has ever come under the observa-

castings is through the "block" gate. This is a modification of the well known "horn" gate, and its success lies in the fact that the metal is so thoroughly



STRAINER GATE RECTANGULAR. STRAINER GATE ROUND.



POP GATE. STOVE PLATE GATE

pool is almost instantly formed, the "pop" gate can not be improved upon.

Flat or "Stove Plate" Gate.

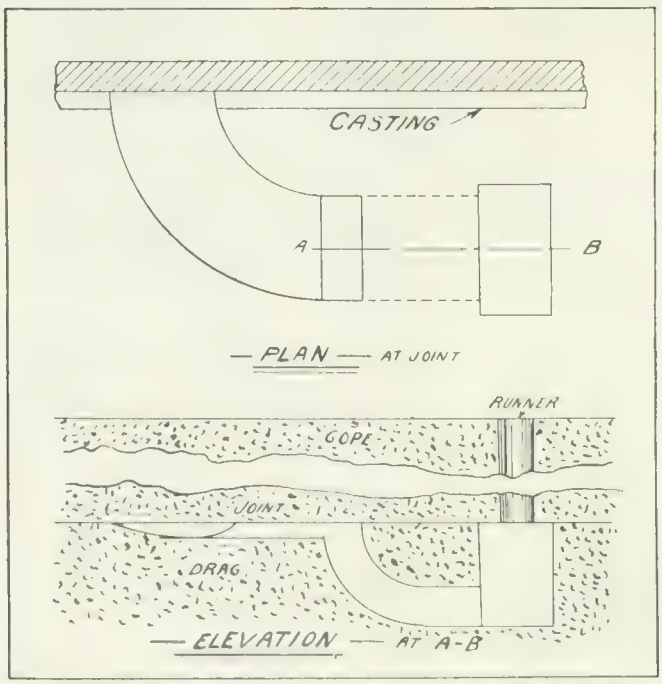
The flat or "stove plate" gate is often used for light work with good results. This gate is usually ¼ in. or ⅜ in. in diameter by from 2 in. to 4 in. wide, and is placed directly on top of the pattern. As the name indicates, it is used extensively for stove-plate work, thin

tion of the writer. When using this gate, the metal is strained through a perforated oil sand core, and it is almost impossible for any dirt to enter the mould. In a moulding machine shop, where the work is poured by foreigners, whose chief desire seems to be getting the iron out of the ladle, this gate is invaluable. While the initial expense of equipping machine boards with strainer

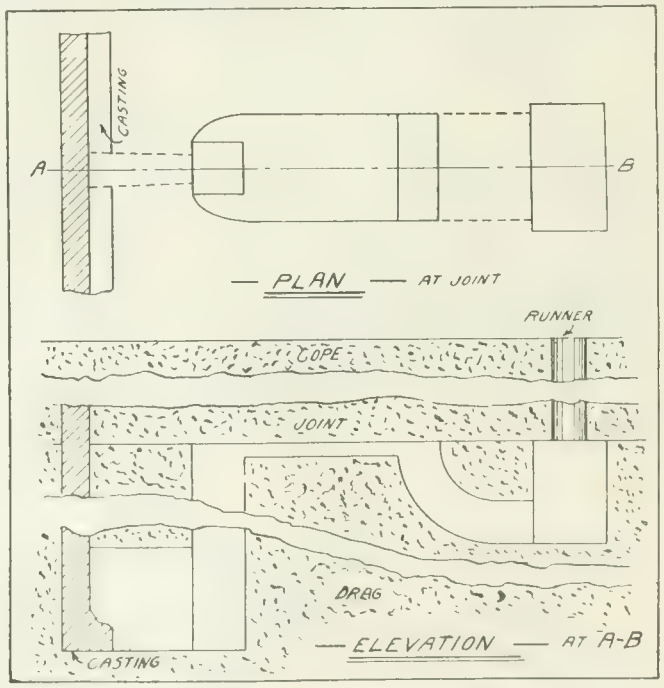
screened there is very little likelihood of any impurities entering the mould. This gate may be made quite heavy, and engine beds weighing several tons are successfully poured with one block gate on each side of the main bearing.

Gating Through the Core.

The old-fashioned method of gating through the core commends itself in many instances, and has the advantage



BLOCK GATE ENTERING CASTING AT JOINT OF MOULD.



BLOCK GATE ENTERING CASTING AT BOTTOM.

plates, etc. It is remarkable how fast one or two of these gates will take the iron, and the mould fills so rapidly there is little danger of cutting.

gates may seem formidable, they will quickly pay for themselves in castings saved.

An attractive method of pouring heavy

that the metal travels through dry sand continuously until it enters the casting. This is a splendid gate for large gas and

(Continued on Page 78.)

Arithmetic for the Machinist and Workshop Operative

By J. H. Rodgers

It will be found by those who have followed the previous lessons and profited by them that the various practical applications can now be easily observed, applied and appreciated.

GRAVITATION.

GRAVITATION is the force which is continually acting between two bodies tending to draw them together. The downward pressure of a body (usually termed the weight) is the attraction of the earth toward that body. The attraction between the earth and any body, at or near the surface, is called the force of gravity, and this force always acts in a straight line between the center of the body and the center of the earth.

The attraction between the earth and a body (and therefore the weight) varies for different locations upon the earth's surface. It is slightly less, above and below, than at the sea level, but if the weight of any body at any place be divided by the force of gravity at that place, the ratio will be the same. This ratio is called the mass of the body, and will always be the same. By formula:

$$\text{Mass} = \frac{\text{weight of body}}{\text{force of gravity}} = \frac{w}{g}, \text{ or } m = \frac{w}{g}.$$

The general laws of weight are that bodies weigh most at the surface of the earth or sea level; that below the surface, the weight decreases as the distance to the center decreases; and that above the surface, the weight decreases as the square of the distance increases. By formula, when

d=distance between the centers of the earth and the body.

R=approximate radius of the earth=4,000 miles.

w=weight of body at given distance above or below the surface.

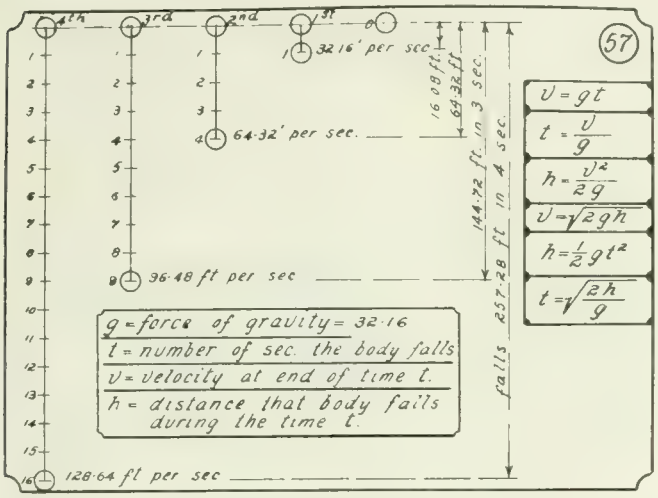
W=weight of body at the surface.

Below the surface:—$wR=dW$.

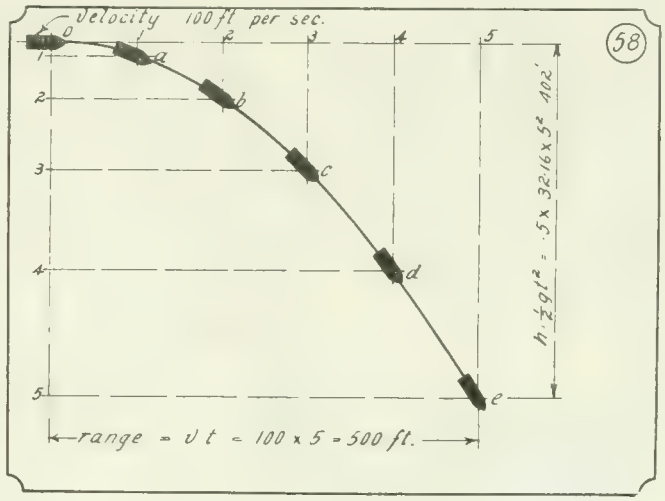
Above the surface:—$wd^2=WR^2$.

To have any material effect upon the weight of a body, the distance above or below the surface must be so great that for all practical purposes the differences need not be considered. If a number of objects irrespective of their size, shape or weight, were allowed to fall within a vacuum, it would be found that each object falls through the same distance in the same time. If, however, the same objects were dropped from a certain height in free air, the one offering the least resistance to the air would reach the ground first, but if the shape and size of each were the same they would all descend the same distance in approximately the same time.

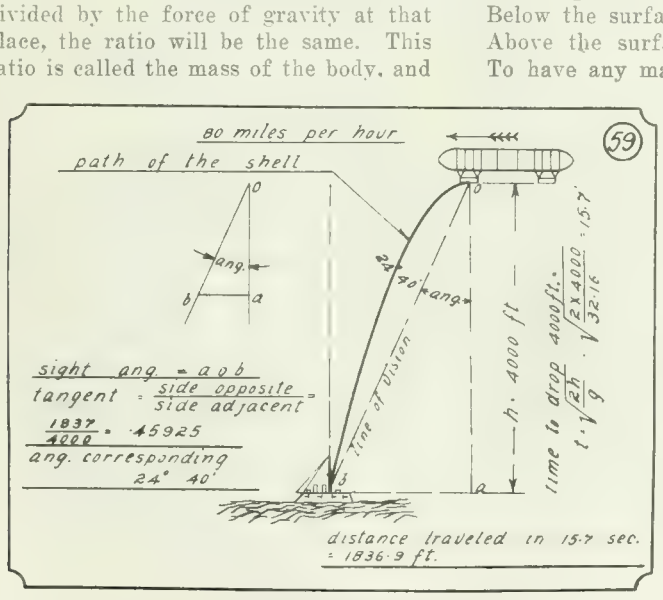
All bodies being attracted toward the earth with the constant force of gravity will gradually increase their velocity until brought to a state of rest. This increase in velocity is called acceleration. The velocity of a falling body due



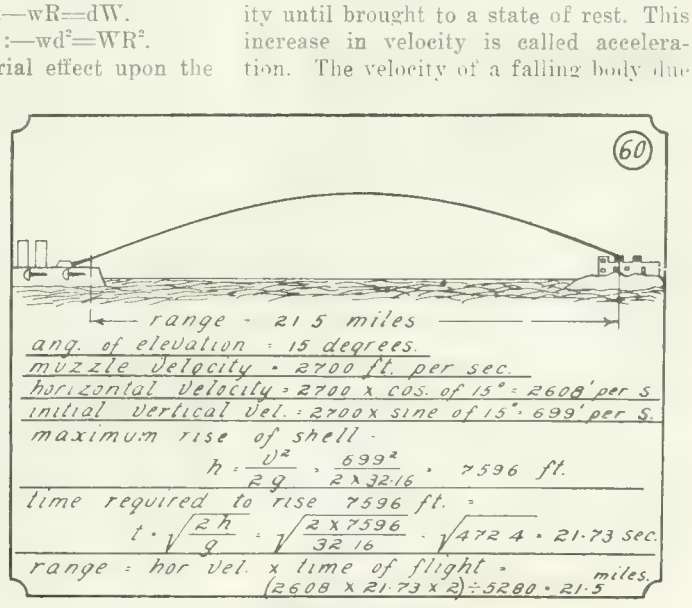
ARITHMETIC CHART 57.



ARITHMETIC CHART 58.



ARITHMETIC CHART 59



ARITHMETIC CHART 60.

to acceleration is the velocity at the end of one second multiplied by the number of seconds.

The acceleration of a falling body is slightly greater at the poles than at the equator, but for most practical purposes the constant 32.16 is generally used; that is the velocity of a falling body at the end of the first second is 32.16 feet per second. At the end of a fall of four seconds, the velocity would be, $32.16 \times 4 = 128.64$ feet per sec. (See Chart 57.)

It has been found by experiment that a freely falling body will fall 16.08 feet during the first second, and for a greater fall the distance will equal 16.08 multiplied by the square of the time in seconds, or

$h = \frac{1}{2} gt^2$ when

h=height of fall.

g=force of gravity=32.16.

t=time of fall in seconds.

If the machine of an aviator turn turtle at a height of 500 feet and fall freely toward the ground, at what velocity will it strike the earth, allowing a reduction of 15 per cent. in acceleration due to the resistance of the air? By formula

$v = \sqrt{(2gh)} = \sqrt{(2 \times 32.16 \times 500)} = 179.3$ ft.

Then $179.3 \times .85 = 152$ ft. per sec.

If a baseball be thrown vertically upwards, and five seconds elapse before it returns to the ground, to what height did it go, and what was the initial velocity? As the total time elapsed was 5 seconds, the time of fall was $5 \div 2 = 2.5$ sec. By formula

$h = \frac{1}{2} gt^2 = \frac{1}{2} \times 32.16 \times 2.5^2 = 100.5$ ft., and

$v = gt = 32.16 \times 2.5 = 80.4$ ft. per sec.

If a projectile be discharged in a horizontal direction at a velocity of 100 ft. per second, what must be the height of gun if shell strikes the ground at the end of the fifth second, and what is the range? As gravity acts constantly irrespective of the velocity, the height=

$$h = \frac{1}{2} gt^2 = \frac{1}{2} \times 32.16 \times 5^2 = 402 \text{ ft.}$$

The range will equal the velocity multiplied by the time of flight or

$r = vt = 100 \times 5 = 500$ ft. (See Chart 58.)

If a dirigible airship is travelling at a rate of 80 miles per hour, and at a height of 4,000 feet; what distance in advance must the explosive be allowed to fall to hit its objective?

To find the horizontal velocity of projectile at time of discharge, resolve the speed of airship into ft. per second.

$$\frac{80 \times 5280}{60 \times 60} = \frac{352}{3} = 117\ 1\text{-}3 \text{ ft per sec.}$$

Time required to drop 4,000 ft. =

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 4{,}000}{32.16}} = 15.7 \text{ sec.}$$

Distance travelled in 15.7 sec. = $117 \times 15.7 = 1836.9$ feet.

= 698.8 ft. per sec.

The greatest height to which the shell will rise =

$$h = \frac{v^2}{2g} = \frac{699^2}{2 \times 32.16} = 7596 \text{ feet.}$$

Time required to rise 7,596 ft.—

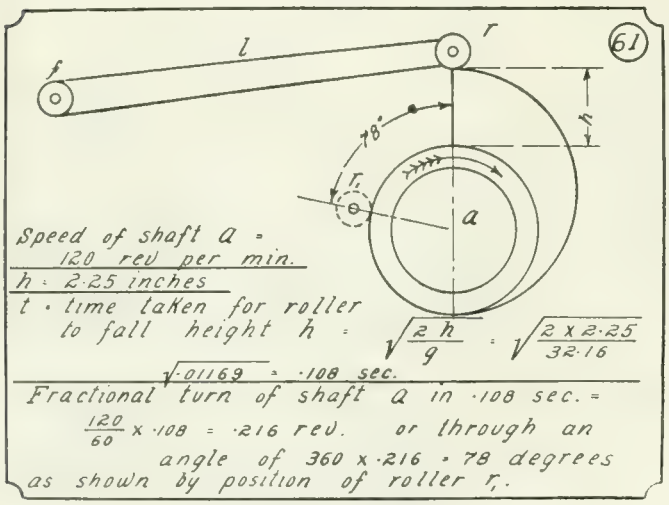
$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 7596}{32.16}} = \sqrt{472.4} = 21.73 \text{ sec.}$$

Then range = horizontal velocity multiplied by the time of flight =

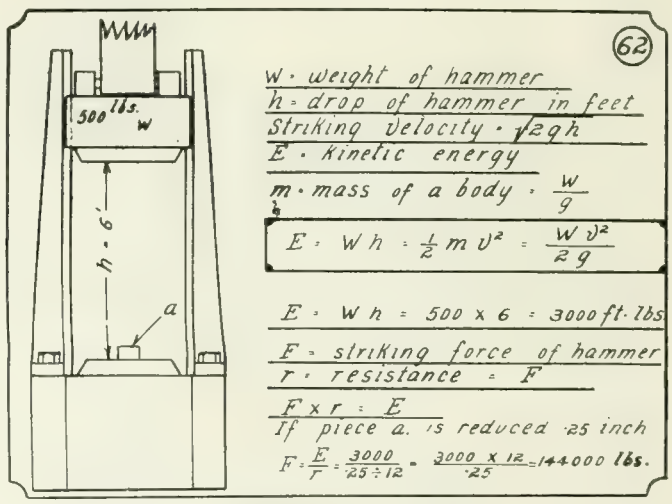
$2608 \times 21.73 \times 2 = 21.5$ miles.

In the sketch of the cam, roller and arm in Chart 61, the shaft A travels at a speed of 120 rev. per min., in the direction of the arrow; at what point on the cam will the roller strike, friction being neglected? Time taken for roller to fall 2.25 inches or .1875 feet =

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times .1875}{32.16}} = 108 \text{ sec.}$$



ARITHMETIC CHART 61.



ARITHMETIC CHART 62.

As this distance could not be readily reckoned at such a height, the angle corresponding must be found. As will be seen from Chart 59, the line of vision ob forms the hypotenuse of the right triangle oab of which the sides are the elevation and distance travelled respectively. The sight angle = a o b, then

$$\text{tangent} = \frac{\text{side opposite}}{\text{side ajacent}} = \frac{1837}{4000}$$

.45925, and angle corresponding = 24° 40 minutes.

If a naval gun (Chart 60) be discharged with a muzzle velocity of 2,700 ft. per sec. at an elevation of 15 degs.; what will be the approximate range, the resistance of the air being neglected? Resolving the angular velocity into the horizontal and vertical components we have horizontal velocity =

2700 × cos. of 15° = 2700 × .96593 = 2608 ft. per sec.

Initial vertical velocity =

2700 × sine of 15° = 2700 × .25882 = 698.8 ft. per sec.

The greatest height to which the shell will rise =

$$h = \frac{v^2}{2g} = \frac{699^2}{2 \times 32.16} = 7596 \text{ feet.}$$

Time required to rise 7,596 ft.—

$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times 7596}{32.16}} = \sqrt{472.4} = 21.73 \text{ sec.}$$

Then range = horizontal velocity multiplied by the time of flight =

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$$t = \sqrt{\frac{2h}{g}} = \sqrt{\frac{2 \times .1875}{32.16}} = 108 \text{ sec.}$$

At 120 rev. per min., the shaft will revolve in .108 sec.

$$\frac{120}{60} \times .108 = .216 \text{ of a revolution,}$$

or through an angle of

$360 \times .216 = 78°$

If the head of a drop hammer, weighing 500 lbs. fall a distance of 6 feet, reducing a piece of metal ¼ of an inch in thickness; what is the kinetic energy and the striking force of the blow? The kinetic energy of a falling body is the weight of the body multiplied by the distance in feet through which it falls, or

$E = Wh = 500 \times 6 = 3000$ ft. lbs.

The striking force of a falling body equals the resistance, and the product of the two equals the kinetic energy, then, as the resistance or compression of the metal = .25 inch, we have

$$F = \frac{E}{r} = \frac{3000}{.25 \div 12} = \frac{3000 \times 12}{.25}$$

144,000 lbs.

EDITORIAL CORRESPONDENCE

Embracing the Further Discussion of Previously Published Articles, Inquiries for General Information, Observations and Suggestions. Your Co-operation is Invited

FACULTY OF SPOTTING PLANT IMPROVEMENTS.

By James E. Cooley.

WE are spoken of as "creatures of habits." In repeating certain acts, in time we become sprinkled with a blindness, so that we do not realize when we are doing these things, and why we are doing them; we become unconscious of the real motive behind our efforts. This is plainly what is called "being in a rut." We cannot see and will not see until circumstances or someone points the way out for us.

Opportunity Always Present.

No person, no place, or institution escapes from this peculiar lethargic state, and the machine shop is included in the list. Where so much depends on saving time and reducing costs, it is hardly believable, until we are shown the facts, how many foolish and wasteful acts are done in the course of one's daily labor. A stranger looking in at the shop windows will see many things, and wonder why they are done. The fact of the matter is that while one can see easily enough from without, none apparently can see from within. It is only as we step outside that we can see inside a circle.

Repitition, doing the same things over and over, has the effect of deadening the brain's activity, and lessening the power of being able to think along new lines. If we study rut-making conditions we will become gradually enlightened and see the necessity of periodically changing the regular order of the things we do, for the mere sake of keeping clear of getting in a rut.

Being Alert to Opportunity.

There is no known method of advancing except by watching for opportunities to improve things. The reason why we do not go ahead and do things is because the impressions we receive do not go in deep enough to affect us, to stir us up to act; even having started something, we soon lose sight of the object we strive for. We adopt means for certain ends, then reverse the order so to speak, shift the thing around and preserve and uphold the means regardless of what the ends are. We become sprinkled with a blindness or what is the same thing, we enter into a state of "forgetfulness." The trouble is as before stated, our impressions do not get in deep enough, so that we wont' forget, so that we will remember what we are doing and why we are doing it. If we can get this fact strongly enough imbedded in our minds we seldom will get into a rut, or getting there, will know when is the opportune time to jump out.

Typical Examples.

A few cases are here cited to show what this rut-evil really is. A machine for grinding was bought and installed in a corner of a room by itself. In order to keep the machine clean and free from dust when not in use, a few yards of cloth were bought to cover it entirely. When workmen desired to use the machine they would pull off the cloth, double it up any old way and toss it on the bench, regardless of whether the bench was clean or not. When their job was finished they would throw back the cloth on the machine, without noting which was the top or dirt-covered side of the cloth. In time the cloth became soiled on both sides, and as much dirt was placed on the machine as was kept off. This repetition of removing and replacing the cloth was kept up for years.

If a "notice" had been put up stating what the cloth was for, which side was to be placed over the machine, and that it was to be taken off carefully and folded, the machine-users might have received a deep enough impression of their duties. One would think, however, that common sense was sufficient to indicate the proper thing to do in a matter of this kind without the aid of printed instructions. No, we can never depend on suppositions. While no great amount of profit was lost in this practice, it was a foolish action each time it was repeated.

A certain section of a factory was set apart for making up small shipments. Under a work-bench was placed several kegs of nails, one behind the other. Each time the packer wanted nails he had to reach down and rummage in the several kegs before he could find the size nails required. It would seem that the waste of this time, and constantly running into this inconvenience would have brought some enlightenment to the workman to the end that it would have led him to have the kegs placed on a bench purposely made, and have each size or sample of nail placed on the outside of each keg. This idea failed to materialize, however, as similar ideas fail to come to us. This inconvenience would never be discovered, and this and other wasteful methods of doing things would never be found out, unless a systematic study of each detail connected with machine-shop work was carried out.

A sweeper was given a long handle brush to sweep the floor of a room containing special machinery, so as not to raise too much dust. When he was through with it he stood it up against a post in the room. The sweeper left, other sweepers came after him, and each one who used that brush placed it back in the same identical place against the post. Workmen walking near it knocked the brush down, then picked it up again, and as many times as that long handle brush was used, and, as many times as it was knocked to the floor, it never occured to anyone to plug a hole in the end of the handle, loop a string through it and hang it to a peg.

Criticism Beneficial.

The reason why we act, why we make changes, is because someone suggests the idea to us to do so, otherwise we never make the effort. We need criticisms as well as suggestions, we need a lot of them, but we are dependent on one another for them, we have got to "see" for each other. Throughout each factory there are useless and wasteful practices blindly and thoughtlessly followed. Each detail needs to be carefully looked into. Disorder is found in the way some things are kept, and things are done that should never be done as they are. For example, crowbars and skid-rolls are kept in a corner or behind a door where they tumble down and workmen stumble over them. An upright-bin, sectioned off, should be built, and these materials placed in it. Again, a helper shovels up the cast-iron chips from under machines and pans into an open box, causing clouds of dust to fly upward, which gets into the belts and bearings and settles on everything. The box should be covered over, having an opening sufficient for the shovel to enter and thus keep the dust down.

Systematic Study of Detail.

Several changes such as these are required in many factories. The need only, is to develop the faculty to see them. This is best acquired by systematically studying each detail and improving it.

THE USE OF FLUX IN THE BRASS FOUNDRY.

By R. Micks.

THE intelligent use of flux in melting brass and other alloys has been proven beyond doubt to be a great help to foundrymen in producing sound castings from the different alloys, and, while in some foundries the flux question is overdone, there are still some brass founders who do not seem to see the advantage of using a flux when melting their metals. The experience of experts along these lines has shown very clearly that the right flux for the right metal when it is used at the proper time in the melting will not only produce better castings, but will also save metal.

Copper.

Good sound castings cannot be produced from copper when it is melted alone, and more chemicals have been tried and more different fluxes proposed for this metal than for any other used in making alloys. The difficulties of securing sound copper castings are due to oxygen-nitrogen and oxygen containing gases, and to overcome this trouble, it is necessary to use a flux or deoxidizing agent.

The flux now generally acknowledged as the best for copper is boron sub-oxide. This flux has a high affinity for these gases, but no affinity for copper. Potassium-ferro-cyanide has also been found to give good results as a flux for copper. Many foundrymen prefer, however, to use deoxidizing agents, such as silicon-copper-magnesium, phosphorus, etc.

Brass and Bronze.

For brass and bronze, common salt is almost universally used as a flux, and some founders claim to have got the best results with rock salt. The action of salt on these metals is that it forms a protective coating and prevents oxide of copper from forming. To obtain the best results from salt as a flux, it should be added when the first metal in the crucible begins to melt, a handful to the ordinary crucible being sufficient. The brass founder will find that, although cheap, salt will improve the quality of his castings whether he is using new metal or scrap. The metals should be kept well covered with charcoal during the melting process.

Aluminum.

For years, aluminum was melted without a flux or covering, as charcoal, on account of the lightness of aluminum, was almost sure to become mixed with the metal and cause black spots in the castings. Chloride of zinc has proved to be the most valuable flux for aluminum. The action of this flux when used on aluminum is that the zinc combines with the oxygen, which is taken up from the aluminum oxide, and forms zinc oxide. This is then skimmed off, together with the aluminum chloride, which is also formed in the reaction, when the flux is added. A piece of chloride of zinc the size of a walnut is sufficient for 50 lbs. of melted aluminum, and when dropped on the thick mass of dross, covering the surface of the melted aluminum, it will be quickly cleared. The metal should next be stirred, after which its surface will be found perfectly clear. Good, clean castings will be produced, but care should be taken not to raise the temperature any higher than is necessary, as melted aluminum should be protected from the air as much as possible.

Nickel.

The flux used for nickel, and the one that has given the best results, is a mixture of lime and fluor-spar, composed of 3 parts lime and 1 part fluor-spar. The lime should be slake, and it should be mixed with the fluor-spar and then be allowed to become solid, when it can be broken into small pieces for use. While fluor-spar alone acts all right as a flux for nickel, it attacks the crucible, affecting the clay in the crucible mixture in such a manner as to dissolve it, then as nothing but the graphite remains, the crucible goes to pieces when grasped by the tongs. Although the lime counteracts the action of the fluor-spar on the crucibles to a certain extent, they very seldom last more than five or six heats in melting nickel.

Turnings, Washings, Grindings, Etc.

As a flux for melting turnings, washing and grindings, nothing excels plaster of paris, it being not only a first-class flux for this purpose, but also having the advantage of being very cheap. Its main feature as a flux in melting these materials is that it dissolves all foreign matter that may be present in the form of sand, oxide, or slag. It melts quickly and forms a liquid slag, and has no bad effects on the crucible. About five pounds of Plaster of Paris mixed with a crucible full of turnings, washings, grindings, etc., should give desirable results. The metal should be allowed to melt in the usual manner, and if the slag is not fluid enough at the conclusion of the melt, more plaster of paris should be added. When the metal is ready to pour, do not attempt to skim, as the slag will rise to the top when the metal is poured into the ingot moulds, and when they are cool the slag of the plaster of paris can easily be detached by a few blows from a hammer.

COMING CONVENTIONS.

American Foundrymen's Association, Atlantic City, N.J.—Sept. 27-Oct. 1.

Foundry and Machine Exhibition Co., Atlantic City, N.J.—Sept. 25-Oct. 2.

THE IMPORTANCE OF CORRECT GATING.

(Continued from Page 74.)

air cylinders cast on end, the method being to cut the gate through the centre of the barrel, a vent being rammed in each half of the core.

The Runner Box Feature.

Even when the utmost care is exercised in gating, the effectiveness of the gate is often discounted by the sloping and spilling of the metal in the runner box when beginning to pour. To guard against this, some founders place a dry sand runner box on top of the mould. In this runner are placed one or two strainer cores, which collect all dirt or slag before it can reach the gate. This runner core is simple to make, and an ordinary coremaker can turn out a great number in the course of a day. One is surprised at the amount of dirt gathered by the strainer cores, a portion of which would almost of necessity enter the gate.

Gating at Heaviest Section.

Some moulders make a practice of always gating a casting at its heaviest section. While this may be quite convenient, it is decidedly wrong, for the reason that the gate keeps the metal alive at this point so long that a spongy condition results. Unfortunately this is not detected until long after the casting leaves the foundry, and many weak castings are laid to faulty design where, with the proper arrangement of gates and risers, they would be sufficiently strong for the purpose intended.

Independent Line of Sight.—An advantage the Allies have over the Germans in the matter of field artillery is that the former have adopted the "independent line of sight" for sighting their guns. In this arrangement, the gun is mounted on an intermediate carriage, and on this carriage the sight is fixed. In laying the gun, the operator revolves the intermediate carriage screw until the sight glass is on the target, when the gun will also be on the target except as regards elevation. The gun is then given elevation separately. The layer, therefore, does not have to attend at all to elevation, another man being told off for this duty.

Winnipeg, Man.—The Board of Control have awarded the contract for the supply of a steam boiler to Babcock & Wilcox, Montreal, at $2,500.

PROGRESS IN NEW EQUIPMENT

A Record of New and Improved Machinery and Accessories for the Pattern, Boiler and Blacksmith Shops, Planing Mill, Foundry and Power Plant

HEAVY DUTY DRILL PRESS, WITH COMPOUND TABLE.

THIS heavy duty drill press is a product of the Colburn Machine Tool Co., Franklin, Pa. It has a capacity to the full cutting edge of 2-inch high speed drills in solid steel, and is of very rigid construction. Shafts are of high carbon steel and all bearings are bushed with bronze and provided with a positive and reliable method of oiling. All speed and feed changes are obtained through positive gearing by means of handles and levers conveniently located within easy reach of the operator.

The drive is through a constant speed belt on to a single pulley. Speed changes are obtained through selective sliding gears controlled by levers within easy reach of the operator. No countershaft is necessary, as a pair of tight and loose pulleys are mounted directly upon the main driving shaft of the machine, parallel to line shaft.

Six changes of speed are obtained, and never more than two pairs of gears are in mesh at any one time. All changes are made by sliding gears, no clutches being used. Splash lubrication is employed and gears and bearings receive a constant flood of oil.

The spindle is of forged high carbon steel. The thrust is taken on "Hess-Bright" ball thrust bearings spherically seated, which provide for any slight deflections or mis-alignment and distribute the load equally over the full circle of balls. Spindle has a traverse of 16 inches and a No. 5 Morse taper socket.

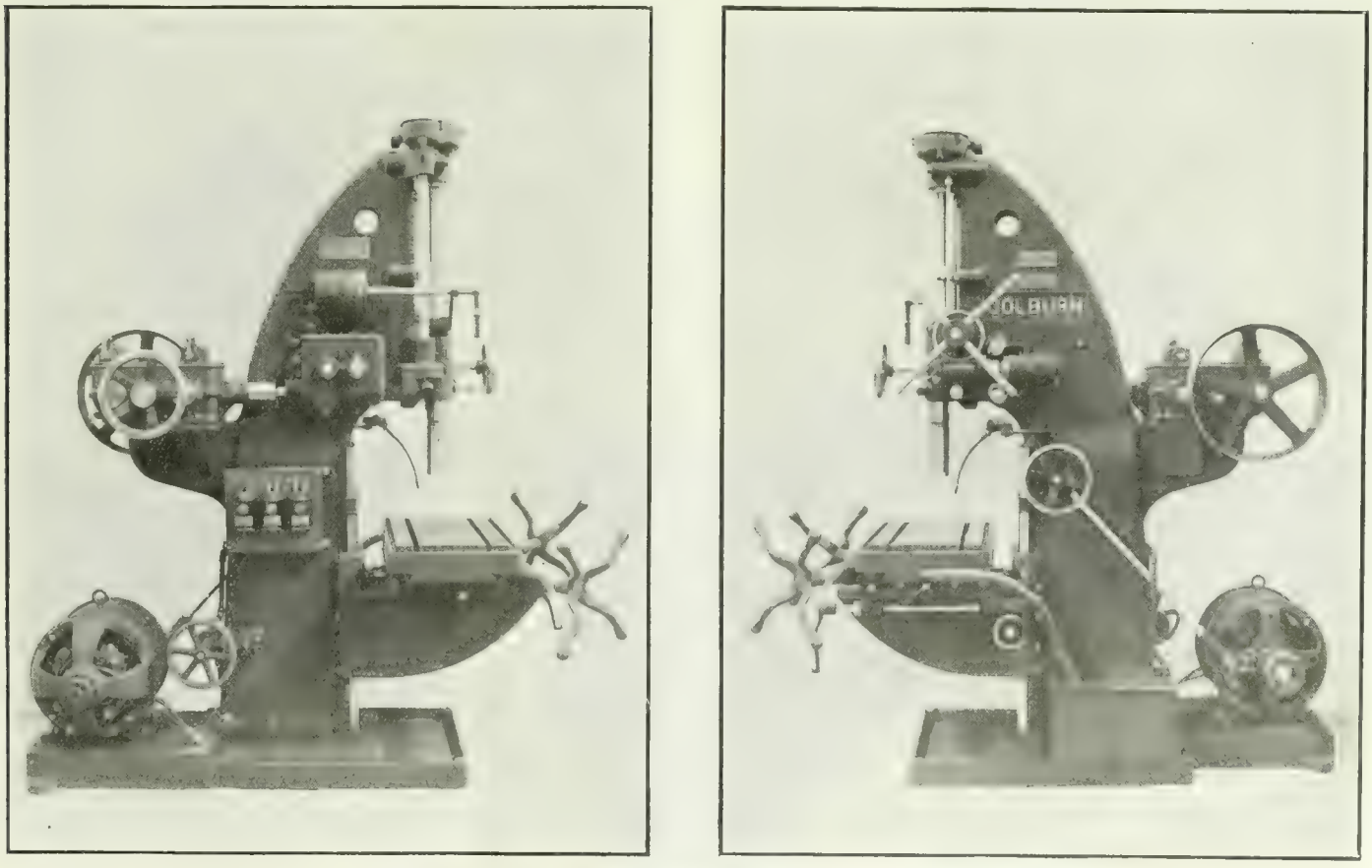
The main spindle driving gear and its pinion have helical teeth. All gears not running in oil bath are covered with dust-proof guards and special grease cups are provided which deliver the lubricant directly on to the teeth. Three spindle feeds are available.

An automatic trip is furnished for tripping the power feed at any desired depth. A final safety trip is also furnished to disengage the feed when spindle has reached its lowest position, thus preventing possible accident.

Quick traverse of the spindle is obtained through four capstan handles, and power feed can be instantly changed to hand feed, or vice versa, by sliding the hand wheel shaft either in or out, thus engaging or disengaging a positive clutch connected to feed train of gearing. A safety device is provided to protect the feed mechanism, which will shear a pin before doing any damage.

The standard table is of the bracket type, gibbed to the column with extra long upright bearing. It has a vertical adjustment of 24 inches by means of rack and pinion and worm and worm wheel. The table can be bored for bushings to support the ends of boring bars up to 3 inches in diameter. The working surface is 18 x 20 inches, and a large oil pan is provided on both sides and in front.

The compound table is not an attachment to the regular table, but consists of a special knee with a table having a rapid movement through spiral worm and rack of 20 inches longitudinally and 8 inches crosswise. Capstan handles are so arranged that the operator standing directly in front of the machine can manipulate the table in both directions without moving from his position. A large oil pocket is cast on each end and a cored opening running entirely through the table drains the lubricant from the



HEAVY DUTY DRILL PRESS WITH COMPOUND TABLE.

left hand to the right hand pocket, and from there it is piped through a flexible tube back to the tank. Grooves along the edges of the table also drain the lubricant from the surface. The working surface of the compound table is 18 inches wide by 30 inches long. An oil pump attached directly to the machine is driven by a belt from pulley on speed box shaft.

The tapping device consists of a pair of friction clutch pulleys mounted on the main driving shaft of the speed box, and, by means of open and cross belts, made to run in opposite directions. To accomplish this the driving shaft is made extra long, and is supported at its outer end by a substantial journal box on the end of a bracket. The clutches are controlled by the lever directly in front of machine. The reversing mechanism of this tapping device being placed directly on the prime mover instead of on the drill spindle, excessive strain on the parts is greatly reduced.

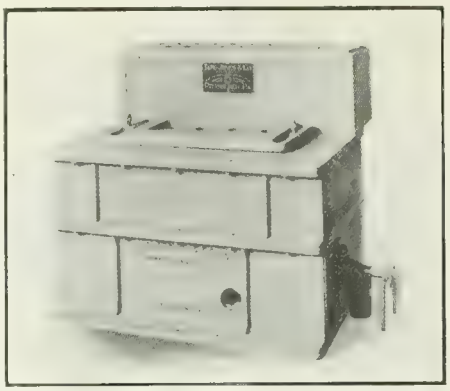
When the machine is to be used for tapping large diameters it is equipped with a tapping hood. This device relieves the strain on the driving key in the spindle gear. The excessive power required to drive a large tap exerts such a pressure on the side of this key that it is almost impossible for the spindle to feed, and this causes the tap to tear the threads and spoil them. With the tapping hood, the friction is reduced to the minimum, since the power is applied through a bar having several times the leverage of the ordinary key in the spindle gear.

With a constant speed motor, the same speed changes are obtained as with regular drive. A "Reliance" motor is mounted on an extension of the base at the rear of the machine, where it is entirely out of the way. A belt drive direct from motor to driving pulley is recommended, and any size or make of constant speed motor from 5 to 10 h.p. can be used, depending upon the work to be performed.

The floor space occupied is 77 in. by 34 in., the height 110 in., and the net weights with plain and compound tables respectively are 3,100 lbs. and 3,700 lbs.

PREHEATED LEAD BATH FURNACE FOR SHELLS.

THE furnace here illustrated has a lead bath, 12 in. wide, 24 in. long, and 12 in. deep. At one end of the bath there is



PREHEATED LEAD BATH FURNACE FOR SHELLS.

arranged a suitable pocket to accommodate the pyrometer couple. The lead bath proper is covered by a cast iron plate, through which are eight openings for inserting shells. The furnace is specially designed for Russian type shells, these being placed in the already mentioned holes open end up. Plugs in these open ends force the shell down into the lead, until each plug strikes the top plate.

There is sufficient bath in the pot, so that when eight shells are inserted the surface of the lead is up to the bottom of the plate covering the pot, and the shell is immersed to within about 1 in. of its top. As these shells are nosed after the heat-treating operation, this 1 in. receives heat treatment at that time.

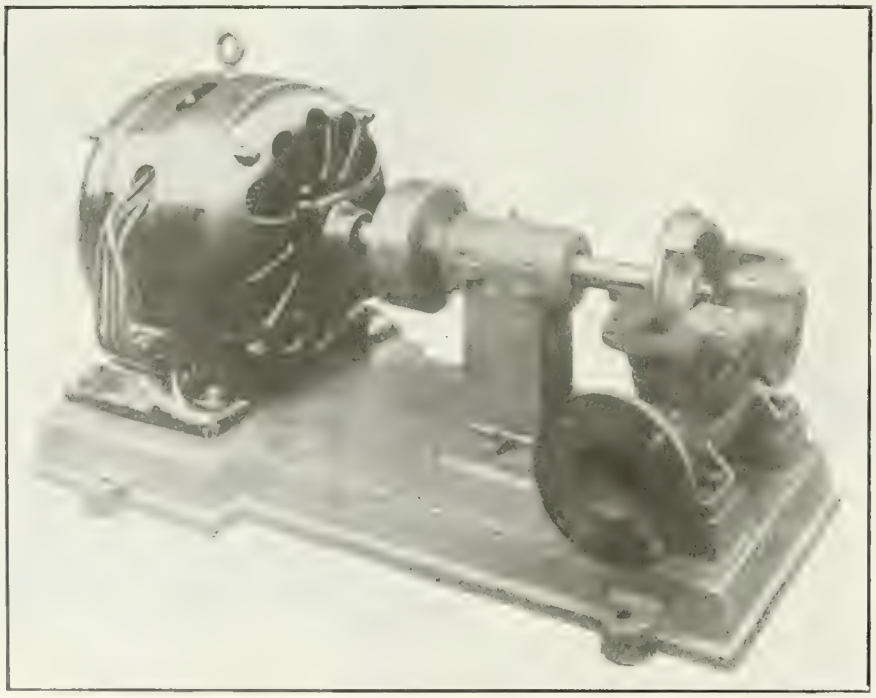
In the preheating chamber to the rear of the furnace there is room for twenty shells. The hot gases from the combustion chamber of the furnace pass through this preheating chamber, heating up these shells, and thus taking advantage of considerable heat that would otherwise be wasted.

A distinctive feature of this furnace is the fact that the combustion chamber is entirely separated from the chamber in which the pot rests, the heat passing from one chamber to the other through suitable openings and being distributed evenly over the surface of the pot. The design eliminates excessive heating of the pot at any one point, thereby increasing the life of the pot itself and the furnace proper. Tate-Jones & Co., Pittsburg, Pa., manufacture this product.

CENTRIFUGAL PUMP FOR THICK LIQUORS.

THE cut herewith shows a high efficiency type of centrifugal pump suitable for handling liquors containing large quantities of solids, chemicals, wood pulp, or gun cotton pulp solution. The impeller is designed along high efficiency lines, but has very wide passages in proportion to its capacity, the design being such that, in spite of these wide passages, a high efficiency is obtained without having the pump characteristic such as to produce a heavy overload on the driving motor when operating at pressures below the rated pressure.

The pump has a horizontally-parted case which facilitates access to the interior for convenience of inspection, cleaning and repairs. The pedestal bearing shown is equipped with two ball bearings operating in a housing packed with a non-fluid oil or light ball-bearing grease. These are so arranged as to carry not only the radial load, but any thrust that may come on the pump in either direction. The impeller, however, is provided with a balancing ring so as to secure approximate hydraulic balance. On account of the large passages through the impeller, the pump is also very suitable for pumping sewage, as solids which would ordinarily choke up a small capacity impeller pass freely through the pump.



CENTRIFUGAL PUMP FOR THICK LIQUORS.

The particular pump shown is driven by a single phase motor, and, for the purpose of keeping down the starting current, a special centrifugal clutch coupling is provided, which allows the motor to come up to speed before the load comes on the motor. Either this type of coupling or the standard type of flexible coupling with steel pins and rubber bushings is furnished. This type pump is particularly suited for handling nitrated cotton liquors in connection with the manufacture of gun cotton.

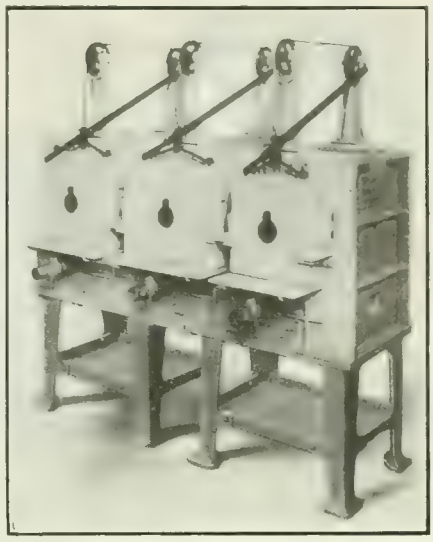
The pump is manufactured by the D'Olier Centrifugal Pump and Machine Co., Philadelphia.

VERTICAL TYPE SUCTION OILER.

TO meet the demand for an oiler embodying the same principle as their universal type (a description of which appeared in these columns some time ago), the Hanna Engineering Works, Chicago, have developed the vertical type shown in the accompanying illustration. The operation of these oilers is entirely automatic, because suction action takes place immediately the air moves and ceases the instant the air is shut off. The necessary amount of lubricant at the proper place and time is, therefore, realized. A chamber containing an absorbent is kept saturated from another large oil storage chamber surrounding it, and air passing through the lubricator becomes sufficiently charged with oil to properly lubricate all surfaces with which it subsequently comes in contact.

VERTICAL TYPE SUCTION OILER.

The universal type oiler can be attached to air line in any position, operating equally well in any plane or angle, and can be filled in no matter what position. The vertical type, on the other hand, can be used only in the position shown. These oilers are made with ¾-inch, 1-inch and 1½-inch pipe connections.



THREE-CHAMBER DIE HARDENING FURNACE.

THREE-CHAMBER DIE-HARDENING FURNACE.

THE description and illustration refer to a three-chamber die-hardening furnace manufactured by Tate-Jones & Co., Pittsburg, Pa. It consists of three distinct separate chambers, two of which are 18 in. wide, 18 in. deep, and 10 in. high. The third chamber is 12 in. wide, 18 in. deep, and 10 in. high. Each has a separate combustion chamber located underneath and separated by a fire brick slab, the heat passing from the combustion chamber through long narrow slots at the sides of this slab into the heating chamber, giving a furnace of semi-muffle construction. Each chamber is fired independently by natural gas or fuel oil burner. Compactness is a feature of the arrangement, and for die work, where long soaking preheating heats are desired before bringing up to the final hardening temperature, special usefulness is claimed.

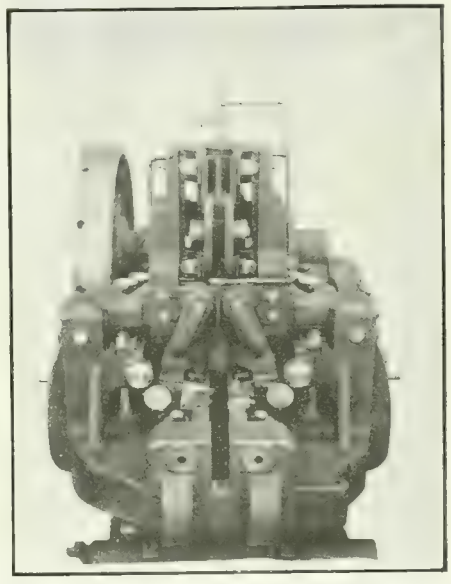
With this furnace, two chambers can be used for preheating and one chamber for hardening, or the three chambers can be used independently for entirely different work. A lever arm is fastened to the rear sheave bracket, and is attached with a suitable sliding arrangement to the lifting links on the door, so that the door can be readily raised and lowered by the movement of this lever. The counterweights for each door drop in the rear of the furnace.

NEW HAMMER BOLT HEADING MACHINE.

IN line with their adopted policy of developing bolt and nut machinery, in which hard manual labor is reduced to a minimum, the National Machinery Co., Tiffin, Ohio, have perfected, and are offering a new type of "hammer" bolt heading machine, termed the "National Continuous Motion Semi-Automatic Hammer Header." This machine is for making square, hexagon and tee head bolts from heated stock, and the following illustrations show some of the features embodied in the design.

About 60 per cent. of the square, hexagon and tee head bolts manufactured are the product of the "hammer" type of bolt header; and the aim of this new design machine is to effect the gripping, starting and stopping movements automatically, so as to free the operator of this labor and enable him to devote his entire attention and energy to feeding the machine. The design has not stopped here, however, for not only are these movements accomplished mechanically and automatically, but the main shaft, heading slide and hammer slides of the machine run continuously like a rivet header—making operation continuous, so that the machine, in a sense, "sets the pace" for the attendant.

A big advantage is gained, too, in having the main shaft, heading slide and hammer slides run continuously, doing away thereby with a starting and stopping clutch on the main shaft, and thus minimizing the attendant troubles of wear and clutch repair. Elimination of this clutch also makes higher speeds



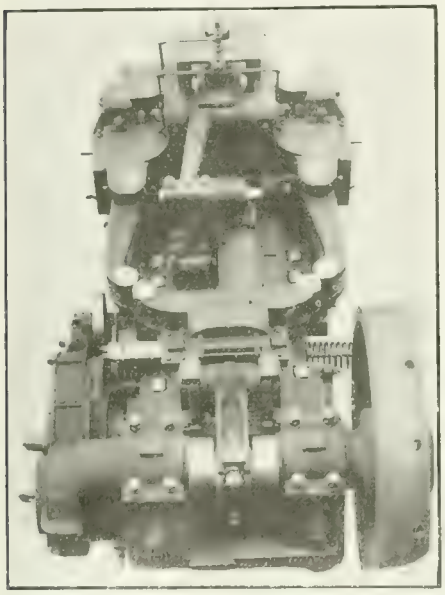
FRONT VIEW SHOWING SHEAR EQUIPMENT FOR MAKING BOLTS OFF THE ROD.

possible. A feature of the design is the ability to set or "time" the machine to make any quality of bolt wished—from

three to eight blows in one cycle of operation; and, with the machine thus set to deliver a predetermined number of blows, the quality of output and finish is necessarily uniform. The length of time, also, that the grips are open for feeding can be regulated to suit the needs or ability of the operator, according to the length or type of bolt being made. These changes are effected through a simple gear and cam construction.

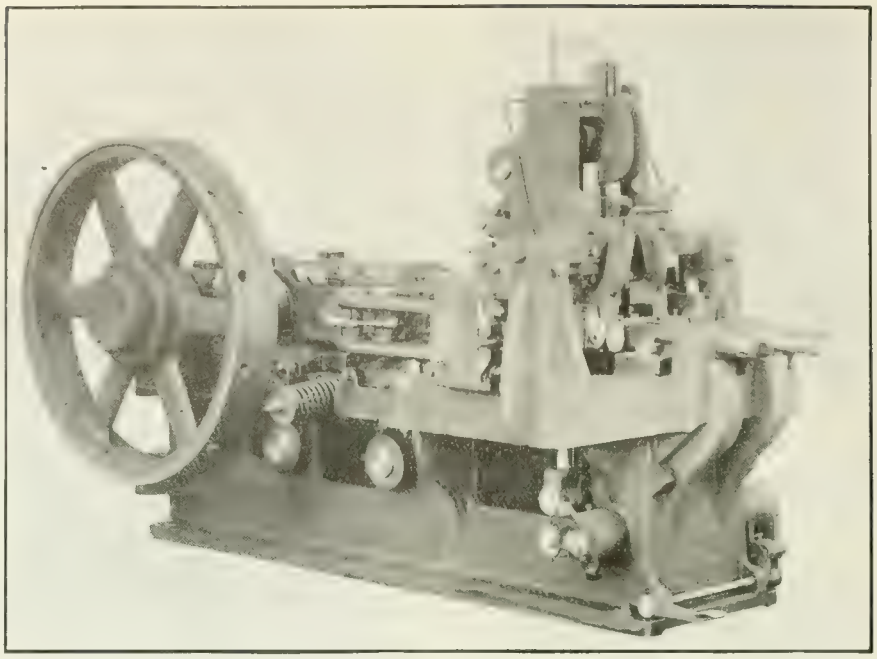
The bed of the machine is of box type, of large proportions and heavily ribbed, insuring stiffness and rigidity as well as strength. The various working parts and details are designed correspondingly. This new hammer header of 1 in. size weighs in round numbers 13,000 pounds, and runs at 140 r.p.m. on its maximum work.

The rigid construction, combined with the mechanically operated grip, makes it practical to introduce a cut-off attachment in the gripping dies, so that short bolts can be made directly off the rod. Short bolts ordinarily are hard to tong and to grip, and require cut-out dies that are expensive to make and maintain. With this shear or cut-off in the grip dies, however, short bolts are made with ease and facility, and four to six bolts can be made in one heat, depending somewhat, of course, upon the diameter and length of bolt made.



REAR VIEW, SHOWING GENEROUS PROPORTIONS OF WORKING PARTS.

Another departure in this design is the lever construction for carrying the lower hammer. In previous designs the lower hammer was carried in a slide, similar to the side and top hammers, and the scale dropping off the bolt as it was being forged got on to this slide, and this, with the action of the water, caused much trouble because of the excessive wear. This wear caused disalignment of the lower hammer, and demanded constant attention. The new construction eliminates this wear. The side and top hammer slides in this design are operated by bronze bushed links in place of cams and rolls.

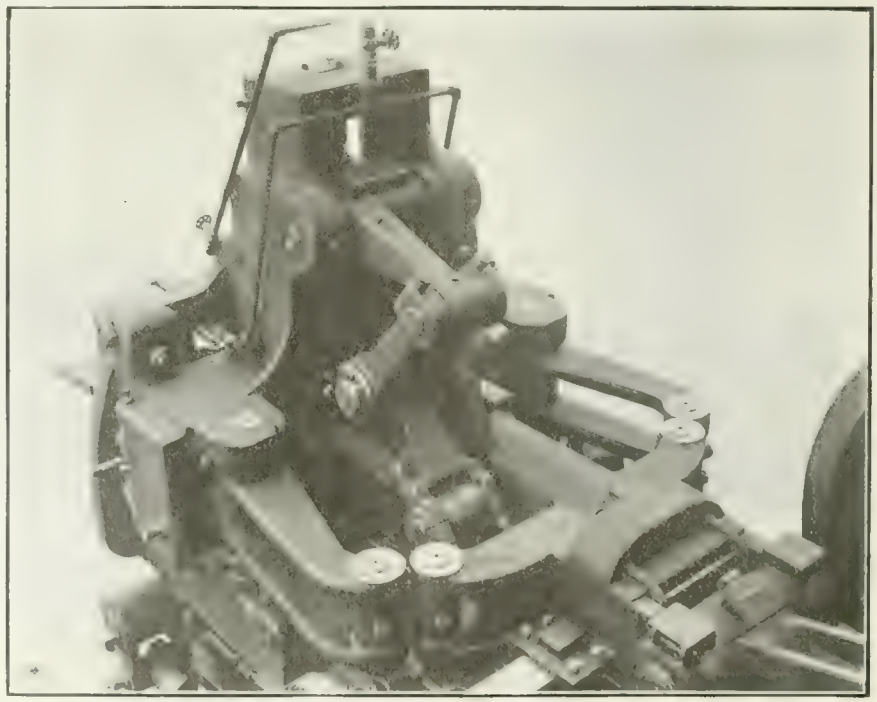


THE "NATIONAL" CONTINUOUS-MOTION SEMI-AUTOMATIC HAMMER BOLT HEADER.

The flywheel is of the "National" friction-slip construction, which fills the role of an automatic safety device in case cold stock or an excess of metal is gripped in the dies and obstructs the travel of the heading tool. An automatic relief is also provided on the gripping mechanism to protect the machine against damage, should the operator accidentally get stock or some foreign object in the grips, other than in the holding grooves, which would prevent the dies from closing, and the machine from completing its cycle.

The slides have been made extra long, and the shaft bearings are of large diameter and bronze bushed, the main shaft bearings being self-oiling. Practically all the bearings have a large oil pocket or cup oiler that is easily accessible; and these pockets, as well as all the oil holes, are provided with sliding or hinged covers to exclude entrance of any possible scale, dust or foreign substance that could induce friction.

This new hammer header is built in $\frac{3}{4}$ in., 1 in., and $1\frac{1}{2}$ in. capacities, for either belt or motor drive.



SHOWING ARRANGEMENT OF HAMMER LEVERS AND BRONZE BUSHED LINKS.

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Vol. XIV. JULY 15, 1915 No. 3

PRINCIPAL CONTENTS.

SHELLS AND GENERAL SUPPLIES FOR BRITAIN.

If we might judge by the activities of our engineering and metal-working plant managements relative to the further development of the manufacture of shrapnel and high explosive shells in their every and complete feature, there is abundant evidence that if someone has not blundered, at least dissatisfaction over the paucity and scope of the orders placed exists. It has long since been proved that we can produce shells of first quality and in quantity ad lib, but, being now informed that our efforts lack all merit because only "empty" shells have been made, we naturally get up in arms to defend ourselves and at the same time give indication of both claiming and demanding the opportunity to produce shells with "fixed ammunition" and of earning the accruing merit by our handiwork.

Little compliment has been paid our engineering establishments during all these months of war in that no notice seems to have been taken in official circles of how they grasped and made a huge success of this shell forging and machining business. What was accomplished in this respect many months ago is as yet being only partly realized—much less appreciated officially, and little wonder is it that being fully aware of the call and necessity for "Shells, and Shells, Then More Shells," our leading metal-working plant managements have banded themselves together to "press their suit" without the official aid which was their right to expect, but their misfortune to lean too implicitly upon.

The concentration of effort indicated gives but concrete expression to a gradually developed necessity relative to shell manufacture in our Dominion. The steps already taken to establish and equip plants for the supply of "fixed ammunition" may be taken as a result of the initiative of our plant managements and their staffs. Arrangements are, we understand, now proceeding smoothly and satisfactorily with respect to the provision of fixed ammunition for the various sizes and types of shells being manufactured in Canada, and within the next two months it is expected that the various plants devoted to this feature will be in a position to cope with the output of what are known as "empty shells."

Some half dozen concerns are either equipping or are getting close to production stage relative to the manufacture of brass cartridge cases, and in the matter of the explosive charges, time fuses and detonators, the necessary arrangements have also been made. Much of course is expected from the coming interviews between Mr. Thomas—the accredited representative of Britain's Minister of Munitions, and our Shell Committee, and not the least important movement in the direction of fuller shell making opportunity is that which seeks to have our manufacturers' committee form a unit at the various conference sessions.

Further to the purchase of supplies for the British forces at home and on the European continent, it may be stated that a department for the purpose is now organized and operative in room 114, the Windsor Street Station Block, Montreal. Edward FitzGerald, assistant general purchasing agent of the C.P.R., has been deputed by Sir Thomas Shaughnessy to take charge of this special work. The supplies requirements will, of course, be both varied and numerous, and will in many instances reach to considerable proportions. Manufacturers of such commodities as are being used both on service and for consumption are invited to furnish particulars of their products, which should include prices, degrees of quality, quantities available, procurable and produceable on short notice. Shells, remounts and fodder do not come within the scope of the departmental activities.

SELECTED MARKET QUOTATIONS

Being a record of prices current on raw and finished material entering into the manufacture of mechanical and general engineering products.

PIG IRON.

Grey Forge, Pittsburg	$13 20	$13 45
Lake Superior, charcoal, Chicago	.....	15 75
Ferro Nickel pig iron (Soo)	.....	25 00

	Montreal.	Toronto.
Middlesboro, No. 3	21 00	.....
Carron, special	22 00	.....
Carron, soft	22 00	.....
Cleveland, No. 3	21 00	.....
Clarence, No. 3	21 00	.....
Glengarnock	25 00	.....
Summerlee, No. 1	25 00	.....
Summerlee, No. 3	25 00	.....
Michigan charcoal iron.	25 00	.....
Victoria, No. 1	21 00	19 00
Victoria, No. 2X	21 00	19 00
Victoria, No. 2 Plain	21 00	19 00
Hamilton, No. 1	20 00	19 00
Hamilton, No. 2	20 00	19 00

FINISHED IRON AND STEEL.

Per Pound to Large Buyers.	Cents.
Common bar iron, f.o.b., Toronto	2.20
Steel bars, f.o.b., Toronto	2.20
Common bar iron, f.o.b., Montreal	2.20
Steel bars, f.o.b., Montreal	2.20
Bessemer rails, heavy, at mill	1,25
Steel bars, Pittsburgh	1.25
Twisted reinforcing bars	2.15
Tank plates, Pittsburgh	1.25
Beams and angles, Pittsburgh	1.25
Steel hoops, Pittsburgh	1.30

F.O.B., Toronto Warehouse.	Cents.
Steel bars	2.10
Small shapes	2.35

Warehouse, Freight and Duty to Pay.	Cents.
Steel bars	1.65
Structural shapes	1.75
Plates	1.75

Freight, Pittsburgh to Toronto.

18.9 cents carload; 22.1 cents less carload.

BOILER PLATES.

	Montreal.	Toronto.
Plates, ¼ to ½ in., 100 lb.	$2 35	$2 25
Heads, per 100 lb.	2 55	2 45
Tank plates, 3-16 in.	2 60	2 45

OLD MATERIAL.

Dealers' Buying Prices.	Montreal.	Toronto.
Copper, light	$12 50	$12 50
Copper, crucible	14 50	14 50
Copper, unch-bled, heavy	14 00	14 00
Copper, wire, unch-bled.	14 00	14 00
No. 1 machine, compos'n	11 50	12 50
No. 1 compos'n. turnings	10 50	9 25
No. 1 wrought iron	6 00	6 00
Heavy melting steel	5 75	6 00
No. 1 machin'y cast iron	10 50	10 50
New brass clippings	12 00	12 00
No. 1 brass turnings	10 00	10 00
Heavy lead	4 50	5 00
Tea lead	$ 3 50	$ 3 75
Scrap zinc	12 00	14 00

W. I. PIPE DISCOUNTS.

Following are Toronto jobbers' discounts on pipe in effect June 25, 1915:

	Buttweld Black	Buttweld Gal.	Lapweld Black	Lapweld Gal.
Standard				
¼, ⅜ in.	63	32½	....	....
½ in.	68	41½	....	....
¾ to 1¼ in.	73	46½	....	....
2 in.	73	46½	69	42½
2½ to 4 in.	73	46½	72	45½
4½, 5, 6 in.	....	....	70	43½
7, 8, 10 in.	....	....	67	40½
X Strong P. E.				
¼, ⅜ in.	56	32½	....	....
½ in.	63	39½	....	....
¾ to 1½ in.	67	43½	....	....
2, 2½, 3 in.	68	44½	....	....
2 in.	....	....	63	39½
2½ to 4 in.	....	....	63	42½
4½, 5, 6 in.	....	....	66	42½
7, 8 in.	....	....	59	35½
XX Strong P. E.				
¼ to 2 in.	44	20½	....	....
2½ to 6 in.	....	....	43	19½
7 to 8 in.	....	....	40	16½
Genuine Wrot Iron.				
⅜ in.	57	26½	....	....
½ in.	62	35½	....	....
¾ to 1½ in.	67	40½	....	....
2 in.	67	40½	63	36½
2½, 3 in.	67	40½	66	39½
3½, 4 in.	....	....	66	39½
4½, 5, 6 in.	....	....	63	36½
7, 8 in.	....	....	60	33½

Wrought Nipples.	
4 in. and under	77½%
4½ in. and larger	72½%
4 in. and under, running thread.	57½%
Standard Couplings.	
4 in. and under	60%
4½ in. and larger	40%

MILLED PRODUCTS.

Sq. & Hex. Head Cap Screws	65%
Sq. Head Set Screws	65 & 10%
Rd. & Fil. Head Cap Screws	45%
Flat & But. Head Cap Screws	40%
Finished Nuts up to 1 in.	70%
Finished Nuts over 1 in. N.	70%
Semi-Fin. Nuts up to 1 in.	70%
Semi-Fin. Nuts over 1 in.	72%
Studs	65%

METALS.

	Montreal.	Toronto
Lake copper, carload	$21 50	$21 50
Electrolytic copper	21 25	21 25
Castings, copper	21 00	21 00
Tin	45 00	46 00
Spelter	28 00	28 00
Lead	7 50	7 50
Antimony	40 00	40 00
Aluminum	40 00	40 00

Prices per 100 lbs.

BILLETS.

	Per Gross Ton
Bessemer, billets, Pittsburgh	$20 00
Openhearth billets, Pittsburgh	20 00
Forging billets, Pittsburgh	25 00
Wire rods, Pittsburgh	25 00

NAILS AND SPIKES.

Standard steel wire nails, base	$2 40	$2 35
Cut nails	2 50	2 70
Miscellaneous wire nails	75 per cent.	
Pressed spikes, ⅝ diam., 100 lbs.	2 85	

BOLTS, NUTS AND SCREWS.

	Per Cent.
Coach and lag screws	75
Stove bolts	80
Plate washers	40
Machine bolts, ⅜ and less	70
Machine bolts, 7-16 and over	60
Blank bolts	60
Bolt ends	60
Machine screws, iron, brass	35 p.c.
Nuts, square, all sizes	4¼c per lb. off
Nuts, Hexagon, all sizes	4¾c per lb. off
Iron rivets	72½ per cent.
Boiler rivets, base, ¾-in. and larger	$3.25
Structural rivets, as above	3.25
Wood screws, flathead, bright	85, 10, 7½, 10 p.c. off
Wood screws, flathead, Brass	75 p.c. off
Wood screws, flathead, Bronze	70 p.c. off

LIST PRICES OF W. I. PIPE.

Standard. Nom. Diam.	Price. per ft.	Extra Strong, Sizes Ins.	Price per ft.	D. Ex. Strong. Size Ins.	Price per ft.
⅛in	$ .05½	⅛in	$ .12	½	$ .32
¼in	.06	¼in	.07½	¾	.35
⅜in	.06	⅜in	.07½	1	.37
½in	.08½	½in	.11	1¼	.52½
¾in	.11½	¾in	.15	1½	.65
1 in	.17½	1 in	.22	2	.91
1¼in	.23½	1½in	.30	2½	1.37
1½in	.27½	1½in	.36½	3	1.86
2 in	.37	2 in	.50½	3½	2.30
2½in	.58½	2½in	.77	4	2.76
3 in	.76½	3 in	1.03	4½	3.26
3½in	.92	3½in	1.25	5	3.86
4 in	1.09	4 in	1.50	6	5.32
4½in	1.27	4½in	1.80	7	6.35
5 in	1.48	5 in	2.08	8	7.25
6 in	1.92	6 in	2.86	....	.....
7 in	2.38	7 in	3.81	....	.....
8 in	2.50	8 in	4.34	....	.....
8 in	2.88	9 in	4.90	....	.....
9 in	3.45	10 in	5.48	....	.....
10 in	3.20	....	....	....	.....
10 in	3.50	....	....	....	.....
10 in	4.12	....	....	....	.....

COKE AND COAL.

Solvay Foundry Coke	$5.75
Connellsville Foundry Coke	4.85-5.15
Yough, Steam Lump Coal	3.83
Penn. Steam Lump Coal	3.63
Best Slack	2.99

Net ton f.o.b. Toronto.

IRON PIPE FITTINGS.

Canadian malleable, 35 per cent.; cast iron, 60; standard bushings, 60; headers, 60; flanged unions, 60; malleable bushings, 60; nipples, 75; malleable, lipped unions, 65.

MISCELLANEOUS.

Putty, 100 lb. drums	$ 2.70
Red dry lead, 100-lb. kegs, per cwt.	9.67
Glue, French medal, per lb.	0.18
Tarred slaters' paper, per roll	0.95
Motor gasoline, single bbls., gal.	0.18
Benzine, single bbls., per gal.	0.18
Pure turpentine, single bbls.	0.66
Linseed oil, raw, single bbls.	0.73
Linseed oil, boiled, single bbls.	0.76
Plaster of Paris, per bbl.	2.50
Plumbers' Oakum, per 100 lbs.	4.00
Lead wool, per lb.	0.09
Pure Manila rope	0.16
Transmission rope, Manila	0.19½
Drilling cables, Manila	0.17½
Lard oil, per gal.	0.60

POLISHED DRILL ROD.

Discount off list, Montreal and Toronto 40%

PROOF COIL CHAIN.

¼ inch	$8.00
5-16 inch	5.35
⅜ inch	4.60
7-16 inch	4.30
½ inch	4.05
9-16 inch	4.05
⅝ inch	3.90
¾ inch	3.85
⅞ inch	3.65
1 inch	3.45

Above quotations are per 100 lbs.

TWIST DRILLS.

	%
Carbon up to 1½ in.	60
Carbon over 1½ in.	25
High Speed	40
Blacksmith	60
Bit Stock	60 and 5
Centre Drill	20
Ratchet	20
Combined drill and c.t.s.k.	15

Discounts off standard list.

REAMERS.

	%
Hand	25
Shell	25
Bit Stock	25
Bridge	65
Taper Pin	25
Centre	25
Pipe Reamers	80

Discounts off standard list.

COLD DRAWN STEEL SHAFTING.

At mill	40%
At warehouse	40%

Discounts off new list. Warehouse price at Montreal and Toronto.

TAPES.

Chesterman Metallic, 50 ft.	$2.00
Lufkin Metallic, 603, 50 ft.	2.00
Admiral Steel Tape, 50 ft.	2.75
Admiral Steel Tape, 100 ft.	4.45
Major Jun., Steel Tape, 50 ft.	3.50
Rival Steel Tape, 50 ft.	2.75
Rival Steel Tape, 100 ft.	4.45
Reliable Jun., Steel Tape, 50 ft.	3.50

SHEETS.

	Montreal	Toronto
Sheets, black, No. 28	$3 00	$3 00
Canada plates, dull, 52 sheets	3 10	3 50
Canada plates, all bright	4 25	4 50
Apollo brand, 10¾ oz. galvanized)	6 40	6 40
Queen's Head, 28 B.W.G.	6 50	6 50
Fleur-de-Lis, 28 B.W.G.	6 30	6 30
Gorbal's Best, No. 28	6 50	6 50
Viking metal, No. 28	6 00	6 00
Colborne Crown, No. 28	6 30	6 30

BOILER TUBES.

Size	Seamless	Lapwelded
1 in.	$10 00	.....
1¼ in.	10 00	.....
1½ in.	10 00	.....
1¾ in.	10 00	.....
2 in.	10 50	9 20
2¼ in.	12 10	.....
2½ in.	13 05	12 10
3 in.	15 75	12 70
3¼ in.	.....	13 90
3½ in.	20 00	15 00
4 in.	25 50	18 90

Prices per 100 feet, Montreal and Toronto.

BELTING—NO. 1 OAK TANNED.

Extra heavy, sgle. and dble.	50 & 10%
Standard	60%
Cut leather lacing, No. 1	$1.20
Leather in sides	1.10

ELECTRIC WELD COIL CHAIN B.B.

3-16 in.	$9.00
¼ in.	6.25
5-16 in.	4.65
⅜ in.	4.00
7-16 in.	4.00
½ in.	4.00

Prices per 100 lbs.

WASTE.

WHITE.	Cents per lb.
XXX Extra	0 10¼
X Grand	0 09¾
XLCR	0 09¼
X Empire	0 08½
X Press	0 07¾
COLORED.	
Lion	0 07⅛
Standard	0 06⅜
Popular	0 05¾
Keen	0 05¼
WOOL PACKING.	
Arrow	0 16
Axle	0 11
Anvil	0 08
Anchor	0 07
WASHED WIPERS.	
Select White	0 09
Mixed Colored	0 06¼
Dark Colored	0 05¼

This list subject to trade discount for quantity.

BELTING RUBBER.

Standard	50%
Best grades	30%

The General Market Conditions and Tendencies

This section sets forth the views and observations of men qualified to judge the outlook and with whom we are in close touch through provincial correspondents.

Toronto, Ont., July 13, 1915. — War orders are the principal feature of interest in business circles and it is generally thought that large contracts will be placed in Canada for military equipment and supplies. The placing of the C.P.R. Purchasing Department at the service of the British Government will facilitate the purchase of supplies and also stimulate business in this direction. Manufacturers have now another organization to deal with in addition to the Commission appointed by the Canadian Government. The result of all this endeavor cannot but be of the greatest benefit to many Canadian manufacturers and a stimulus to a variety of industries. The foregoing is altogether apart from the shell industry, which of course is under the direction of the Shell Committee. In this regard, however, Russian and French shell orders have to be considered, as big business may eventually result. Contracts for Russian shells have of course already been placed, while an order for French shells is already on the tapis.

Taking everything into consideration, the outlook has during the last few weeks improved considerably, and indications point to a more extensive development in trade than was perhaps anticipated during the earlier stages of the war.

The Export Association of Canada which was recently organized and which

has its headquarters in Montreal, is endeavoring to enlist the support of the leading Toronto manufacturers. A conference was held here last week for this purpose. The Association was formed with a view to developing the export trade of Canada and to take as full advantage as possible of opportunities for trade that will arise during the period of reconstruction that will follow the war.

Steel Markets.

The shell industry continues to dominate the steel trade and production is being speeded up to meet the demand. Activity has spread to the steel foundries where blanks are being cast for the 4.5 shells, preparatory to forging, thus giving additional work for the forging plants. The demand for merchant bars is still light, and the outlook in the steel trade as regards ordinary business is improving and prices are very firm. Canadian mills have advanced prices on iron and steel bars to $2.20 f.o.b. Toronto.

The market for galvanized sheets is easier, but prices are practically the same as at the last advance; only a few makers of galvanized sheet products are offering material on account of the continued high price of spelter. Makers of tool steel are much concerned over the great scarcity of tungsten, one of the chief ingredients of high-speed steels. The price of this alloy has advanced considerably and tool steels are higher proportionately. The big demand for high-speed steel for tools and drills makes the situation more acute.

Further improvement in the steel trade is reported from United States centres. The export trade continues to develop, while the domestic business is also improving. Prices are very firm at the recent advances, and it is expected that present quotations will be maintained, if not further advanced.

Pig Iron.

There is no improvement in the pig iron situation as regards foundry requirements, although the blast furnaces at the steel plants are in active operation. Prices are unchanged.

Scrap Metals.

The market is firm for copper and brass scrap, and the demand continues good. Heavy melting steel is more active and prices are firmer. Scrap zinc and lead are quiet but unchanged.

Machine Tools.

The situation in the machine tool trade is practically the same as last week, fewer inquiries have been received by local dealers, but they are busy filling orders already placed. The absence of contracts for shells has been satisfactorily explained and further orders will be placed as soon as the firms making cartridge cases, etc., can meet the demand so that fixed ammunition only will be shipped to England. Interest will be centred on 18 pdr. and 4.5 high-explosive shells when the activity is renewed, and there will be a good demand for the necessary machines and tooling fixtures. Many makers of machine tools are booked up for months ahead, and prices are advancing.

Supplies.

Business continues to be very satisfactory with an increasing demand in connection with making shells. Chucks, collapsible taps, twist drills, reamers, belting, cutting compound, etc., are all in good demand. The only price change of importance to note this week is in iron pipe fittings, which have advanced. The new discounts are as follows: Canadian malleable, 25 per cent. for A, and 35 per cent. for B and C classes; cast iron, 60 per cent.; malleable bushings, 60 per cent., and standard bushings, 60 per cent.

Metals.

There is nothing of particular interest to note in the metal market this week. Prices are at the same level and generally steady. The situation locally continues undisturbed and the demand for metals for munitions is unabated. Ordinary business appears to have improved, but is hardly up to the normal. A scarcity of spelter and aluminum exists with no expectation of any relief for some time. The Imperial Government has placed an embargo on the exportation from Great Britain of all metals necessary in the manufacture of munitions.

Tin.—The market weakened slightly at the end of last week but has recovered and is now firmer and quiet. The present consumption of tin is very large and will continue to be so for some time. Quotations are unchanged at 46c per pound.

Copper.—The market is quiet and the tone is inclined to be easier. The copper situation, however, is a strong one and with consumption on the increase any change in price will probably be upwards. Local quotations are unchanged at 21½c per pound.

Spelter.—The market is steady but the general situation has not improved. There is good business being done in all positions up to the end of the year and some of the export orders go into the first quarter of next year. Quotations are nominal at 28c per pound.

Lead.—The market is dull and easier but quotations are unchanged. The lead situation is improving gradually and an upward movement is expected in some qparters. Lead is quoted locally at 7½c per pound.

Antimony.—The market is quiet but the demand is somewhat better, although prices have an easier tendency. Quotations are nominal at 40c per pound.

Aluminum.—The scarcity of supplies of aluminum is still felt, and prices are being maintained at the present unusually high level. Quotations are nominal at 40c per pound.

CANADIAN GOVERNMENT PURCHASING COMMISSION.

The following gentlemen constitute the Commission appointed to make all purchases under the Dominion $100,000,000 war appropriation:—George Gault, Winnipeg; Henry Laporte, Montreal; A. E. Kemp, Toronto. Thomas Hilliard is secretary, and the commission headquarters are at Ottawa.

St. John, N.B., July 10, 1915.—Friends in the manufacturing trade throughout the Eastern Provinces will join with many others in extending congratulations to Hon. John E. Wilson, M.P.P., upon his appointment to the important position of deputy receiver-general and manager of the Government Savings Bank in this city. The appointment was recently announced. Hon. Mr. Wilson is president of the firm of J. E. Wilson, Ltd., iron founders and sheet metal workers. He has been prominent in local business and political circles for many years. Hon. Mr. Wilson was for some time a member of the old common council, and in 1908 was elected to a seat in the Legislature at Fredericton, being re-elected in 1912. He was then made a member of the cabinet without portfolio, and was also chosen president of the legislative council. He will now quit public life and retire to the quieter precincts of the civil service in an office well deserved after his years of service to the Conservative party.

The big spandril arch bridge, the largest in the world, across the Reversing Falls, St. John, N.B., will soon be thrown open to the public. The flooring was finished this week by A. R. C. Clark & Son, and the approaches will be finished in the near future by J. McVey & Son. The new bridge is of steel and is a magnificent and inspiring structure.

The contract for the substructure and approaches of the new highway bridge over the Petitcodiac river at Moncton, N. B., has been awarded to Engineers and Contractors, Ltd., a Nova Scotia concern. L. A. Keith is at present acting as their agent in this city. The president of the firm is E. R. Reid of Annapolis, N.S., while his partner is E. M.

Archibald, a graduate in engineering, from McGill University, and also residing in the Annapolis valley. Work has been started on the bridge, and will be rushed to completion as rapidly as the circumstances warrant.

The Maritime Dredging & Construction Co. is setting forms in place along the top of No. 1 extension, West St. John. Concrete will later be poured into the wall until it is elevated to a level with the new docks. This wall, known as the "Connolly Dock," is 300 feet in length and about six feet below the required height.

Miles E. Agar, hardware manufacturer, of St. John, and Matthew Lodge, of Moncton, N.B., have left for England to confer with the directors of the Maritime Oil Fields, Ltd., respecting the extension of a lease of the oil and gas privileges of the New Brunswick Petroleum Co., now held by the former concern. The lease is just expiring, and Messrs. Agar and Lodge plan to consult about its extension and enlargement.

TRADE WITH RUSSIA PROSPECTS.

GREAT possibilities for Canadian trade with Russia are revealed in the first report sent by Special Trade Commissioner Conrad F. Just to the Department of Trade and Commerce.

Mr. Just has concluded his investigations in the Petrograd district, and is now working south and east. He has had a number of conferences with members of the Russian Government and with leading bankers, having had considerable assistance from the British Commercial Attache and British Consul at Petrograd. He points out that at the outbreak of the war, Germany, after 25 years of effort, had to her credit 52 per cent. of the import trade of Russia. Since the war, the conventional tariff rates have been withdrawn, the general tariff increased by 10 per cent., and a surtax of 100 per cent. imposed against Germany and Austria. The war has not devastated any true Russian areas, but districts which constituted the base of the German economic penetration of Russia.

Russia, says Mr. Just, has great powers of recuperation, is internally rich and prosperous, and affords "great opportunities for industrial enterprise for which the consuming power is at hand." These factors, the report states, should make Russia a great market, "and if the conditions be rightly studied and understood, Canadian manufacturing industries, by the nature of the products, which are adapted in so many instances to the requirements of a developing country like Russia, may reasonably expect to participate in the trade with that market."

Agriculture is the occupation of 85 per cent. of the Russian people, and the manufacturing industry furnishes an insignificant output in relation to the country's needs.

Canadian Exports Confused.

Mr. Just says that Canadian machinery exports to Russia have been confounded with those from the United States. He advises Canadian traders to organize on the basis of a close study of the Russian requirements and to keep in touch with the consumer by means of local agents, who play a very prominent part in connection with the foreign trade of Russia. Firms seeking trade with Russia should enter the market in groups or syndicates, this being possible when the products of such firms do not compete, but are complementary to each other. It is also desirable to have assembling shops in Russia, particularly for machinery, thus saving on Customs duties and permitting tendering on Government works. A start should be made in Petrograd, where the Russian fashions are set.

"The successful participation of Canada in the contracts of the Russian Government for munitions of war, railway rolling stock, and it is believed for locomotives and other materials, has created lively interest in Russian official banking and commercial circles," says the report, "and should prove an excellent advertisement of the capabilities of the Canadian industrial system."

Canadian leather supplies, it is added, would be snapped up at high prices. "A pair of Russian army boots has a life of two months."

SHELL MANUFACTURERS IN CONFERENCE.

FULL information with regard to the shell-making capacity of Canadian industries will be placed before the British Government's representative, Mr. Thomas, who is expected to reach Ottawa some day this week. With this object in view, a number of leading manufacturers have held a meeting here in conference with members of the Shell Committee. There were present T. A. Russell, of the Russell Motor Car Co.; Wm. Inglis and Campbell Rives, of the John Inglis Co.; Mr. Findlay, of the Massey-Harris Co.; Mr. Gurney and Mr. Tinson, of the Crocker Wheel Co.; Alex. Goldie, of Goldie and McCullough; Col. Frederick Nicholls, of the Canadian Allis-Chalmers Co.; Robert Hobson, of the Steel Company of Canada; Mr. Niven, of the Otis Fensom Co.; Col. J. B. Miller, of the Polson Iron Works, Gen. Bertram and other members of the Shell Committee.

It was explained by Col. Nicholls that the meeting had been called for the purpose of considering what more could be done to relieve the ammunition shortage in view of the approaching visit of Mr. Thomas. Large sums of money would be spent if necessary on equipment for turning out completed shells on a large scale.

It was suggested by Mr. Findlay that, through the proper medium, the Shell Committee, a delegation of manufacturers should meet Mr. Thomas and discuss the situation with him. He thought that if fixed ammunition is required, assembling plants should be established on a large scale, so that larger orders could be undertaken.

Mr. Nicholls stated that they had received proposals to take foreign orders, but preferred to wait for orders from the War Office through the Shell Committee. Larger orders would enable the manufacturers to invest capital in additional equipment without the danger of the work being insufficient to warrant the outlay. He suggested that the Government or the Shell Committee should establish a large assembling plant or, if not, the manufacturers were prepared to do it.

It was proposed by Mr. Russell that a statement be prepared for Mr. Thomas, showing the number of firms ready to undertake shell manufacture on a large scale, with details as to which of these firms would undertake the machining of shells, the manufacture of cartridge cases, of primers, and so on.

General Bertram assured the meeting that the War Office was prepared to place further and larger orders with the shell committee as soon as it could be shown that the work could be done. General Pease had assured him that Canada could secure all the orders necessary as soon as the manufacture of cartridge cases and the loading capacity warranted the placing of further orders. General Bertram explained the difficulties that had arisen in connection with the manufacture of cartridge cases and the loading.

The meeting ended after a full and exhaustive discussion and with the suggestion that the manufacturers co-operate with the Shell Committee in conferring with Mr. Thomas.

CANADIAN MINERAL PRODUCTS FOR BRITAIN.

THROUGH the medium of the High Commissioner's Office, trial orders have been given by the British authorities for certain Canadian mineral products found in Ontario and Quebec, and those who grumble about Canada's share of war contracts have no conception of the large orders already passed, at least so we are given to understand. The Imperial Government is adopting the policy

of giving the Dominion every possible chance.

Col. Pelletier, agent-general for Quebec, is also supplying certain minerals from Quebec to the French analysts, who hold out great hopes of utilizing the same for war munitions.

BRITISH OPENING FOR SAW-MILL MACHINERY.

MANUFACTURERS of saw mill and woodworking machinery may be interested in Trade Inquiry No. 831, which has been received from Harrison Watson, Trade Commissioner at London, notifying the Department of Trade and Commerce, Ottawa, of the name of a firm, who are large manufacturers of saw-mill and woodworking machinery. As their own plant is heavily engaged in Government work, and as they are receiving inquiries from all parts of the world which they cannot deal with themselves, they are prepared to receive complete information from any Canadian manufacturers of saw-mill and woodworking machinery, to enable them to negotiate for orders without being obliged to refer any further to Canada. They wish to be placed in the same position as that in which the manufacturer would put his traveller or agent. Canadian manufacturers, wishing to avail themselves of such an opportunity may be supplied with the name of the firm by applying to the Department of Trade and Commerce, Ottawa. (Refer File No. 810).

MARKET FOR WIRE RODS IN BRITAIN.

CONSIDERABLE quantities of wire rods have hitherto been sent to the United Kingdom from Germany, and as supplies have now ceased, consumers are experiencing much difficulty in obtaining adequate supplies from home sources. Another factor which is handicapping producers is the difficulty of securing labor, as so many skilled men have enlisted in the army.

If Canadian manufacturers are able to export these rods, the information ascertainable covering the following particulars may be of service. The rods required should be of soft and hard steel and in what is known to the trade as 4, 5 and 6 gauge. The soft steel rods should have 0.10 per cent. carbon, and the hard steel rods 0.40, 0.50 and 0.60 per cent. carbon. The soft rods are intended to be drawn into wire for the making of such articles as boot rivets and wire mattresses, while wire obtained from the hard rods is used among other purposes for card clothing and also for wire rope making.

Maxville, Ont.—The Borden Milk Co. contemplate the erection of a condensed milk factory here.

CANADIAN COMMERCIAL INTELLIGENCE SERVICE

The Department of Trade and Commerce invites correspondence from Canadian exporters or importers upon all trade matters. Canadian Trade Comissioners and Commercial Agents should be kept supplied with catalogues, price lists, discount rates, etc., and the names and addresses of trade representatives by Canadian exporters. Catalogues should state whether prices are at factory point, f.o.b. at port of shipment, or, which is preferable, c.i.f. at foreign port.

CANADIAN TRADE COMMISSIONERS.

Argentine Republic.

H. R. Poussette, 278 Balcarce, Buenos Aires. Cable Address, Canadian.

Australasia.

D. H. Ross, Stock Exchange Building, Melbourne, Cable address, Canadian.

British West Indies.

E. H. S. Flood, Bridgetown, Barbadoes, agent also for the Bermudas and British Guiana. Cable address, Canadian.

China.

J. W. Ross, 6 Kiukiang Road, Shanghai. Cable Address Cancoma.

Cuba.

Acting Trade Commissioner, Lonja del Comercio, Apartado 1290, Havana. Cable address, Cantracom.

France.

Phillipe Roy, Commissioner General, 17 and 19 Boulevard des Capucines, Paris. Cable address, Stadacona

Japan.

G. B. Johnson, P.O. Box 109, Yokohama. Cable Address, Canadian.

Holland.

J. T. Lithgow, Zuidblaak, 26, Rotterdam. Cable address, Watermill.

Newfoundland.

W. B. Nicholson, Bank of Montreal Building, Water Street, St. John's. Cable address, Canadian.

New Zealand.

W. A. Beddoe, Union Buildings, Customs Street, Auckland. Cable address, Canadian.

South Africa.

W. J. Egan, Norwich Union Buildings, Cape Town. Cable address, Cantracom.

United Kingdom.

E. de B. Arnaud, Sun Building, Clare Street, Bristol. Cable address, Canadian.

J. E. Ray, Central House, Birmingham. Cable address, Canadian.

Acting Trade Commissioner, North British Building East Parade, Leeds. Cable address, Canadian.

F. A. C. Bickerdike, Canada Chambers, 36 Spring Gardens, Manchester. Cable address, Cantracom.

Fred. Dane, 87 Union Street, Glasgow, Scotland. Cable address, Cantracom.

Harrison Watson, 73 Basinghall Street, London, E.C., England. Cable address, Sleighing, London.

CANADIAN COMMERCIAL AGENTS.

British West Indies.

Edgar Tripp, Port of Spain, Trinidad. Cable address, Canadian.

R. H. Curry, Nassau, Bahamas.

Colombia.

A. E. Beckwith, c-o Tracey Hmos, Medellin, Colombia. Cables to Marmato, Colombia. Cable address, Canadian.

Norway and Denmark.

C. E. Sontum, Grubbeged No. 4, Christiana, Norway. Cable address, Sontums.

South Africa.

D. M. McKibbin, Parker, Wood & Co., Buildings, P.O. Box 559, Johannesburg.

E. J. Wilkinson, Durban, 41 St. Andrew's Buildings, Durban, Natal.

CANADIAN HIGH COMMISSIONER'S OFFICE.

United Kingdom.

W. L. Griffith, Secretary, 17 Victoria Street, London, S.W., England.

INDUSTRIAL AND CONSTRUCTION NEWS

Establishment or Enlargement of Factories, Mills, Power Plants, Etc.; Construction of Railways, Bridges, Etc.; Municipal Undertakings; Mining News.

Engineering

Smith's Falls, Ont.—The Frost & Wood Co. have received an order for making shells.

Brampton, Ont.—It is reported that the Pease Foundry Co., have received an order for shells.

Montreal, Que.—W. A. Dean, of Toronto, will establish a plant for building flying machines near Montreal.

Corbyville, Ont.—The H. Corby Distillery Co. are in the market for a motor-driven pump and an air compressor.

Gananoque, Ont.—The Steel Co. of Canada, Ltd., will probably build an extension to their plant at this place. Head office is at Hamilton, Ont.

Chatham, N.B.—The Maritime Foundry Co., are erecting a factory to make shells. The building will be 80 x 40 feet and will cost about $40,000.

Toronto, Ont.—The Board of Control has instructed Works Commissioner Harris to report on the cost and advisability of building car shops in this city.

Paris, Ont.—The Bell Foundry Co. of St. George have installed a complete machinery equipment for the manufacture of shells, and they commenced operations this week on a large order.

Sherbrooke, Que.—The City Council has decided to proceed with the erection of the new gas plant at an estimated cost of $75,000. Tenders for one gas holder will be accepted in the meantime.

Smith's Falls, Ont. — The Frost & Wood Co. have received an order for shells to the extent of $100,000. The company will install additional machinery. The initial outlay for the equipment will be $25,000.

Toronto, Ont.—The Chevrolet Motor Co., of Canada, Ltd., which has recently been incorporated with a capital of $50,000 will establish a plant here. W. C. Durant, president of the Chevrolet Motor Co., New York City, is interested in the Canadian concern.

Electrical

Smithville, Ont.—The installation of an electric lighting system is under consideration.

Kincardine, Ont.—The council will purchase a number of 60-watt lamps.

Orillia, Ont. — The Orillia Water, Light and Power Commission will extend their transmission lines to Longford.

Toronto, Ont.—The Parks Committee has decided to put cluster lights on University avenue, so that men who have to work by day will get a chance to drill in the open at night. This work will cost $12,000.

Orillia, Ont.—The Orillia Power Commission will probably be able to supply Longford with electric current after all, an alternate route having been secured through Orillia township to Washago and thence to the Standard Chemical Co. works at Longford. John McRae of Ottawa, is consulting engineer for the commission.

Municipal

Burlington, Ont.—The town will raise $50,000 for the proposed sewage system.

Hamilton, Ont.—Fire Chief Ten Eyck has recommended the installation of several fire alarm boxes.

Sackville, N.B.—The Town Council are contemplating additions to the waterworks plant. A pump may be required.

Pembroke, Ont.—The Town Council are considering the purchase of a combination hose wagon and chemical engine. Clerk, A. J. Fortier.

Toronto, Ont.—The Board of Control has decided to proceed with the construction of the new street railway tracks on Bloor street west.

Montreal, Que.—The Controllers reported to the council that a by-law should be adopted without delay to vote a sum of $1,000,000 for needed improvements to the waterworks. In addition to this sum an additional amount of $74,000 is required to expropriate land for waterworks extension purposes, land not ceded to the city.

Hamilton, Ont.—The construction of a reservoir with a capacity of 17,500,000 gallons, and provision for eventually increasing the maximum capacity to 50,000,000 gallons, is recommended by Kerry & Chase, of Toronto, the engineers who have been investigating the possibilities of economizing in the operation of the water works system.

Sarnia, Ont.—The Sarnia Gas & Electric Light Co. has received from the City Council an offer for its entire electrical plant, lines and properties, the sum offered by the corporation being $155,000, which represents the figure advised by Engineer Jeffries, of the Hydro Commission, who some time ago made an estimate of the whole situation. If the company will accept this figure the council will have a by-law prepared to submit the question to the ratepayers.

Mimico, Ont.—The New Toronto Council have definitely decided to link up with Mimico and construct a sewage system and disposal plant which will accommodate the needs of both municipalities. The disposal plant will be built in Mimico, but the council refuse as yet to disclose its exact location. The pump house, a portion of the new works will, however, be constructed at the lower end of Superior Avenue. The cost of the new system will amount to about $50,000, according to the estimates of the engineers.

General Industrial

Peterborough, Ont.—Fire has destroyed the brick plant of Curtis Bros.

Montreal, Que.—The A. Racine Co. are building a carriage factory here.

Martintown, Ont.—A. E. Clingen's sawmill has been destroyed by fire. Loss, $7,000, partially covered by insurance.

Fort William, Ont.—The Ogilvie Milling Co., are considering making an addition to their elevator here which will increase the capacity by 750,000 bushels.

Preston, Ont.—The Hurlbut Shoe Co., which was given a loan of $25,000 from the town, has plans drawn for a three-storey building on Queen street, near the present factory.

Lethbridge, Alta.—It is possible that the Taylor Milling Co. and the Lake of the Woods Co. may erect elevators at Foremost. There are already elevators of the National Grain Co., and the Farmers' Co-Operative Elevator Co. at this point.

Tenders

Ottawa, Ont.—Tenders on the supply of transformers, switches, and equipment will be received until August 3 by the chairman of the Waterworks Commission. Plans and specifications with [illegible] city engineer, R. L. Hancock.

Ottawa, Ont.—Tenders will be received until August 3 for high-lift pumps and motors for the Lemieux Island pumping station. Plans and specifications may be obtained from the consulting engineer, S. B. MacRae, Ottawa.

Oakville, Ont.—Tenders will be received by the chairman of the Oakville Water and Light Commission until Monday, July 26, 1915, for furnishing and installing one electrically-operated turbine pump of 600 Imperial gallons capacity against a head of 300 feet. Specifications may be seen at the office of the Commissioners, Oakville, or at the office of Chipman & Power, engineers, Mail Building, Toronto.

Building Notes

Toronto, Ont.—J. W. Siddall, architect has taken out a permit for a factory to cost $7,000 at 71 Sterling road.

Toronto, Ont.—H. T. LePage has taken out a permit for the erection of a concrete block factory on Dundas street to cost $10,000.

Barrie, Ont.—The general contract for the new Carnegie Library has been let to the Ball Planing Mill Co., of this town. Chapman & McGiffin, of Toronto, are the architects.

Toronto, Ont.—The city architect has issued permits for additions to two public schools, the Scarth road school to cost $22,000, and the St. Clair avenue school to cost $27,300.

Toronto, Ont.—The Borthwick Baking Co. have been granted a permit by the City Architect's Department for the erection of a two-storey addition to their factory on Davies avenue. The work will cost $14,000.

Port Colborne, Ont. — The School Board has adopted the plans for the proposed new school on Steele street which is estimated to cost $35,000. Architect Porter of Niagara Falls, Ont., will prepare specifications, etc.

Vancouver, B.C. — The Merchants Bank has awarded a contract for the erection of a headquarters building in this city, to cost $175,000. It will be of four stories, and will be located at the corner of Pender and Granville streets.

Vancouver, B.C.—Work will start immediately on a three-storey building for the Merchants Bank at Granville and Pender streets, which will cost when completed approximately $175,000. The plans have been drawn up by Somerville & Putnam, architects, of this city.

Railways-Bridges

Vancouver, B.C.—It is announced that the main line of the Canadian Northern Pacific Railway will be ready for operation by September.

Toronto, Ont.—The York County Council has granted a sum of $2,000 towards the construction of Jersey Bridge at North Gwillimburg.

Toronto, Ont.—The York County Council has under consideration the construction of a bridge at Locust Hill, the estimated cost being $20,000.

St. Thomas, Ont.—The London & Port Stanley Railway Commission will in a few days commence the erection of a new station and office building, on Talbot street.

Calgary, Alta.—The City Council are considering the question of extending the street railway tracks to the Sarcee military camp. The citizens are in favor of the extension.

Brantford, Ont.—The electrification of the Lake Erie & Northern Ry. from Port Dover to this place will be proceeded with during the summer. Rolling stock will be purchased.

Calgary, Alta.—George H. Webster has been given the contract to build the Spirit Lake-Grand Prairie branch of the Edmonton Dunvegan and British Columbia Railway, now under construction by J. D. McArthur.

London, Ont.—The London & Port Stanley Railway Commission have closed the deal for the Gootson property on Ottaway Avenue, for car shops. Possession will be given at once, and the work of erecting the buildings will commence shortly.

Arnprior, Ont.—The new bridge to be erected over the Madawaska river at Burnstown by the county council and township council of McNab is to cost in the neighborhood of $26,760. It will be of cement and concrete, and its length will be over 300 feet.

Brantford, Ont.—The offer by the city of the sale of the Grand Valley Railway line from Paris to Galt for $30,000 and electrification of the L. E. & N. Railway, from Port Dover to Brantford has not been accepted by M. H. Todd, General Manager of the Lake Erie. He offered $26,000, the city to retain the Galt powerhouse. He will submit the city's offer to the C. P. R. board, but will not recommend it.

Chatham, Ont.—The Hydro-Electric Power Commission of Ontario is negotiating with the C. N. R. for the purchase of the Chatham, Wallaceburg and Lake Erie Railway, which runs from Erie Beach on the south to Wallaceburg on the north. If purchased, the line will be made the nucleus for a hydro radial system in this part of the province, and the road will be extended to Sarnia through Petrolea and other places about to instal Niagara power.

Brantford, Ont.—The city's offer to the Lake Erie & Northern Railway, through the C. P. R., to sell the Grand Valley Railway from Paris to Galt, has been accepted. The price, it is understood, was $26,000. This means that the Lake Erie & Northern Railway will be electrified from Brantford to Port Dover. This gives electrical railway communication with Lake Erie. Orders for electrifying material will be placed at once and work will be rushed.

Lake Superior Division, G. T. P.—The Lake Superior division of the G. T. P. was taken over by the Government on July 1 under lease, and will be operated as part of the National Transcontinental Railway. The rental as announced previously is $600,000. The Grand Trunk Pacific Railway system now stops at Winnipeg. Hitherto it extended virtually to Fort William via the Lake Superior division, the intervening National Transcontinental link between Graham and Winnipeg having been used by the G. T. P. under a lease from the Government. All the lines east of Winnipeg will now be operated by the Government, the G. T. P. eastbound traffic at Winnipeg being taken over by the Transcontinental.

New Incorporations

The Bull Tractor Co. has been incorporated at Ottawa with a capital of $25,000 to manufacture gas tractors, gas engines, motor trucks, motor cars, etc., at Winnipeg, Man. Incorporators: Garnet Coulter and Percy John Procter, of Winnipeg, Man.

The Nitrogen Products, Ltd., has been incorporated at Ottawa with a capital of $300,000 to manufacture by electrical or other method atmospheric nitrogen, nitric acid and nitrates of all kinds at Toronto, Ont. Incorporators: William Bourne, and William John Lockwood McKay, of Toronto.

Wood-Working

Niagara Falls, Ont.—Pinnes & Sons, are building a box factory here.

Newcastle, N. B.—William Sullivan's planing mill at Redbank was destroyed by fire on July 5.

Hamilton, Ont.—Fire caused between $8,000 and $9,000 damage to the planing mill owned by Thomas Roussel & Son, Nightingale, street, on July 1.

Kentville, N.S.—The Chalmers Redden Co. mill and woodworking plant was destroyed by fire on June 18. The loss is estimated at $6,000, with no insurance.

Beamsville, Ont.—Fire on June 29, destroyed the planing and saw mill owned by Robert E. Book at Smithville. The loss is estimated at $3,000, partly covered by insurance.

Personal

F. McArthur, city engineer of Regina, Sask., has been recommended for a similar position at Guelph, Ont.

Capt. Murray Wilson, manager of the cordite department of the Canadian Explosives Co., was killed on July 6, by an explosion at the plant at Beloeil, Que.

J. H. Plummer, president of the Dominion Steel Corporation, has returned to Sidney, N.S., from Montreal, where he presided at the annual meeting of that company.

Lieut. Alex. C. Lewis, secretary of the Toronto Harbor Board, who holds a commission in the Queen's Own Rifles, has volunteered for active service and is now in camp at Niagara, Ont.

Arthur B. Colville, of Toronto, vice-president and general counsel of the Electric Power Co., controlling the Seymour Power & Electric Co. and Subsidiary Companies, has volunteered for active service and obtained a commission in the 39th Battalion.

Lieut. Freeland M. Bentley, of the Gordon Highlanders, was killed in action on June 18th. Lieutenant Bentley was a son of Captain Thomas K. Bentley, of Port Greville, N.S., the well-known shipbuilder and ship owner. He was a lieutenant in the 93rd Cumberland Battalion, but enlisted in the First Canadian Contingent.

C. H. Mathewson, engineer in charge of the Toronto harbor improvement works, was recently presented with an electric lamp and a gold fob by the sub-engineers and inspectors employed on

the works. Mr. Matthewson succeeded J. G. Sing as engineer in charge of the work, being promoted from the position of senior assistant engineer.

Oliver P. Meckel died at Brockville, Ont., on June 28, of heart failure, aged fifty-one years. For more than twenty-eight years he was connected with the Baird Machinery Co., Pittsburg, Pa., entering its employ in a minor capacity and later traveling extensively. He severed the connection January 1 last on account of ill-health, and went to his summer home on an island in Alexandria Bay.

Trade Gossip

The Turbine Equipment Co., Toronto, has sold three 24 in. x 24 in. "Chapman" rectangular sluice gates.

W. A. Martin & Co. have removed from 70 Lombard Street to their new office at 100 Church Street, Toronto.

The Swedish Crucible Steel Co., of Canada, Ltd., Windsor, Ont., have been authorized to increase their capital stock to $200,000.

The Johnston Heat Regulator Co., Toronto, has been awarded contracts for their system to be installed at the Rosedale and Jesse Ketchum Schools, Toronto.

The Canadian Fairbanks-Morse Co., Toronto, have sold a special gasoline engine outfit to the Hamilton Bridge Co., Hamilton, Ont., for operating a swinging drawbridge.

Windsor, Ont.—An Industrial and Publicity Bureau has been formed to induce factories to locate here. The Board of Trade has opened a fund to finance the scheme.

Ottawa, Ont.—Supplementary letters patent have been issued to the Toronto Type Foundry Co., authorizing them to manufacture and deal in shells, cartridges and other munitions of war.

Shell Manufacturers.—A committee of shell manufacturers has been formed to co-operate with the Shell Committee. Frederic Nicholls, of the Canadian General Electric Co., has been appointed chairman, and Robert Hobson, of the Steel Company of Canada, is vice-chairman.

The Export Association of Canada held a conference in Toronto last week to enlist the support of the Queen City manufacturers. It is expected that a large number of the latter will help the association in the development of Canadian export trade. R. J. Younge, of Montreal, is looking after the association's interests in Toronto.

Britain Stops Export of Metals.—Steps have been taken by the British authorities to prevent the further exportation from Great Britain of lead, spelter, antimony, nickel, or any other metal necessary in the manufacture of munitions of war. Announcement to this effect was made by Munitions Minister Lloyd George in the House of Commons on July 7.

Toronto, Ont.—It is reported that an early start will be made on the new Union Station. It is stated that an arrangement has been made for advances of $4,000,000 by the Bank of Montreal on the guarantee of the C. P. R. and G. T. R., and that all details have been worked out, including the arrangement with the Government in regard to the question of a postal station.

Hamilton, Ont.—The International Harvester Co. announces that it will give employment to 1,500 more men in the course of two or three weeks. On July 19 the malleable iron department will open, and a short time later the entire plant will be in operation. The company is not engaged on war orders to any extent, but the increased activity is caused by orders for farm implements from the West. The Oliver Plow Works will also soon be working to capacity.

Catalogues

"National" Chucks.—The Oneida National Chuck Co., Oneida, N.Y., have issued their 1915 catalogue and price list, covering the full line of chucks which they make. The construction of each type is shown, with special reference to the steel reinforced independent lathe chuck. The price lists also give the principal dimensions for each size.

Cutting-off Machines.—Catalogue A-2 describes the new Davis cutting-off machines which are specially adapted for cutting off bar stock in the manufacture of shells. The various sizes in which this machine is made are illustrated and described fully with the principal dimensions given for each. Copies may be obtained from the W. P. Davis Machine Co., Rochester, N.Y.

Lathes, made by the Seneca Falls Mfg. Co., Seneca Falls, N.Y., are described and illustrated in catalogue No. 26B. The principal lines dealt with include the "Seneca Falls" quick-change gear, screw-cutting engine lathes, the "Star" screw-cutting engine lathes and the "Seneca Falls" speed and wood-turning lathes. A full description is given of each type, with special reference to the principal features and a specification is included for each size. The various attachments are described in detail.

HINTS TO BUYERS

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Abrasive Materials.
Can. Fairbanks-Morse Co., Montreal.
Carborundum Co., Niagara Falls, N.Y.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Toronto.
Ford-Smith Machine Co., Hamilton, Ont.
Gardner Machine Co., Beloit, Wis.
Norton Co., Worcester, Mass.
Stevens, F. B., Detroit, Mich.

Acetylene.
L'Air Liquide Society, Montreal, Toronto.

Acetylene Generators.
L'Air Liquide Society, Montreal, Toronto.

Accumulators, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Wks., Chicago.
Wm. Tod Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood Co., Philadelphia, Pa.

Air Compressors.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Smart-Turner Machine Co., Hamilton, Ont.

Air Hoists.
Q. M. S. Company, Chicago, Ill.
Whiting Foundry Equipment Co., Harvey, Ill.

Air Hose.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Can. Ingersoll-Rand Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.

Air Receivers.
Can. Ingersoll-Rand Co., Montreal.

Air Washers.
Buffalo Forge Co., Buffalo, N.Y.
Can. Sirocco Co., Ltd., Windsor, Ont.

Ammeters.
Brown Inst. Co., Philadelphia, Pa.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Aluminum.
M. & L. Samuel, Benjamin & Co., Toronto.
Tallman Brass & Metal Co., Hamilton.

Alloys, Steel.
H. A. Drury Co., Ltd., Montreal.
Vanadium Alloys Steel Co., Pittsburg, Pa.

Architectural Engineers.
Hooper-Falkenau Eng. Co., New York.

Arbors.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Plessisville Foundry, Plessisville, Que.
Pratt & Whitney Co., Dundas, Ont.

Assembling Stands.
Skinner Chuck Co., New Britain, Conn.

Automatic Chucks.
Garvin Machine Co., New York.

Asbestos Packing.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Autogenous Welding and Cutting Plants.
L'Air Liquide Society, Montreal, Toronto.

Automatic Index Milling Machines.
Garvin Machine Co., New York.
National Machinery and Supply Co., Hamilton.

Automatic Lowering Devices.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Automatic Machinery.
Baird Machine Co., Bridgeport, Conn.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt. & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
Pratt & Whitney Co., Dundas, Ont.
Owen Sound Iron Works Co., Owen Sound.
A. O. Walworth & Co., Chicago, Ill.
Windsor Machine Co., Windsor, Vt.

Automatic Multiple Spindle.
Windsor Machine Co., Windsor, Vt.

Automatic Wood Screw Machines.
Asa F. Cook Co.

Axle Cutters.
Butterfield & Co., Rock Island, Que.
A. B. Jardine & Co., Hespeler, Ont.

Babbitt Metal.
Can. Fairbanks-Morse Co., Montreal.
Hoyt Metal Co., Toronto.
Magnolia Metal Co., Montreal.
Tallman Brass & Metal Co., Hamilton.

Baking Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.
Owen Sound Iron Works Co., Owen Sound.

Ball Bearings.
Can. Fairbanks-Morse Co., Montreal.
Chapman Double Ball Bearing Company, Toronto.

Ball Burnishing Machines.
Baird Machine Co., Bridgeport, Conn.

Banding Machines, Hydraulic.
West Tire Setter Co., Rochester, N.Y.

Barrels, Steel Shop.
Baird Machine Co., Bridgeport, Conn.
Canadian Steel Products Company, Montreal.
Cleveland Wire Spring Co., Cleveland.

Bars, Boring.
Charles F. Elmes Eng. Works, Chicago
Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.

Bar Benders and Straight Edges.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Bar Benders, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Belt Benches.
Tabor Mfg. Co., Philadelphia, Pa.

Belt Dressing and Cement.
Commercial Oil Co., Hamilton, Ont.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Montreal.

Belt Lacing, Leather.
Graton & Knight Mfg. Co., Montreal.

Belting, Chain.
Can. Fairbanks-Morse Co., Montreal.
Graton & Knight Mfg. Co., Montreal.
Jones & Glassco, Montreal.

Belting, Cotton.
Dominion Belting Co., Hamilton.

Belting, Leather.
Can. Fairbanks-Morse Co., Montreal.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Girard Machine & Tool Co., Philadelphia, Pa.
Graton & Knight Mfg. Co., Montreal.
D. K. McLaren, Ltd., Montreal.

Belting, Stitched Cotton Duck.
Dominion Belting Co., Hamilton, Ont.

Belting, Rubber.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Benders, Angle and Tee Iron.
Can. Buffalo Forge Co., Montreal.
Watson-Stillman Co., Aldene, N.J.

Bending Machinery.
John Bertram & Sons Co., Dundas.
Bertrams, Limited, Edinburgh, Scotland.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Buffalo Forge Co., Montreal.
Charles F. Elmes Eng. Works, Chicago
Jardine, A. B., & Co., Hespeler, Ont.
National Machinery Co., Tiffin, Ohio.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Owen Sound Iron Works Co., Owen Sound.
Toledo Machine & Tool Co., Toledo, O.
Steel Bending Brake Works, Chatham, Ont.
Watson-Stillman Co., Aldene, N.J.

Bins, Steel.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Bit Brace Tools.
Wells Bros. Co., Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Blast Gauges, Cupola.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Blocks, Lifting.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.

Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Girard Machine & Tool Co., Philadelphia, Pa.
Sheldons, Ltd., Galt, Ont.

Blow Pipes and Regulators.
L'Air Liquide Society, Montreal, Toronto.

Blue Print Machinery.
Revolute Machine Co., New York.

Bluing Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Boilers.
Can. Locomotive Co., Kingston, Ont.
National Machinery & Supply Co., Hamilton.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Polson Iron Works, Toronto.

Boiler Compounds.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Boiler Graphite.
Dixon Crucible Co., Jersey City, N.J.

Boiler Makers' Supplies.
Jno. F. Allen Co., New York.
Polson Iron Works, Toronto.

Bolt Cutters and Nut Tapers.
Wells Brothers Co., Greenfield, Mass.

Bolts.
Galt Machine Screw Co., Galt, Ont.
London Bolt & Hinge Works, London, Ont.

Bolt and Nut Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas, Ont.
Owen Sound Iron Works Co., Owen Sound.
Gardner, Robt., & Son, Montreal.
Landis Machine Co., Waynesboro, Pa.
National Machinery Co., Tiffin, O.
National Machinery & Supply Co., Hamilton.
Wiley & Russell Co., Greenfield, Mass.

Books
MacLean Publishing Co., Toronto.

Boring Machines, Upright and Horizontal.
John Bertram & Sons Co., Dundas.
Colburn Machine Tool Co., Franklin, Pa.
Detrick & Harvey Machine Co., Baltimore, Md.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co., Hamilton.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghamton, N.Y.
A. O. Walworth & Co., Chicago, Ill.

Boring Machines, Pneumatic, Cylinder.
Baker Brothers, Toledo, O.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Ingersoll-Rand Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
Newton Machine Tool Works, Philadelphia, Pa.
Stow Mfg. Co., Binghamton, N.Y.
A. O. Walworth & Co., Chicago, Ill.

Boring Machines (Railroading).
Newton Machine Tool Works, Philadelphia, Pa.

Boring and Turning Mills.
John Bertram & Sons Co., Dundas.
Colburn Machine Tool Co., Franklin, Pa.
Detrick & Harvey Machine Co., Baltimore, Md.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
A. O. Walworth & Co., Chicago, Ill.

Box Puller.
Jardine, A. B., & Co., Hespeler, Ont.

Boxes, Steel Shop.
Cleveland Wire Spring Co., Cleveland.

Boxes, Tote.
Cleveland Wire Spring Co., Cleveland.

Brakes.
Brown, Boggs & Co., Hamilton, Can.
Whiting Foundry Equipment Co., Harvey, Ill.

Brakes, Heavy Plate Bending and Cornice.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Brass Working Machinery.
A. R. Williams Machy. Co., Toronto.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Warner & Swasey Co., Cleveland.
Niles-Bement-Pond Co., New York.

Brick Cars.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Brick Dryers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Brick Machinery.
Eastern Machinery Co., New Haven.
Sheldons, Ltd., Galt, Ont.

Bridges, Railway and Highway.
Can. Bridge Co., Walkerville, Ont.

Bucket Elevators.
Pangborn Corporation, Hagerstown, Md.

Buckets, Clam Shell, Crab and Dump.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Buffing and Polishing Machinery.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Ford-Smith Machine Co., Hamilton, Ont.
Girard Machine & Tool Co., Philadelphia, Pa.
Gray Mfg. & Machine Co., Toronto.
New Britain Machine Co. New Britain, Conn.

Bulldozers.
John Bertram & Sons Co., Dundas.
Canada Mach. Corporation, Galt, Ont.
E. W. Bliss Co., Brooklyn, N.Y.
National Machinery & Supply Co., Hamilton, Ont.
Watson-Stillman Co., Aldene, N.J.

Burners, Enclosed Flame Gas.
Oven Equipment & Mfg. Co., New Haven, Conn.

Burners, Fuel, Oil and Natural Gas.
Whiting Foundry Equipment Co., Harvey, Ill.

Burring Reamers.
Wells Brothers Company, Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Butterises.
Wells Brothers Company, Greenfield, Mass.

Burrs, Iron and Copper.
Parmenter & Bulloch Co., Gananoque

Canners' Machinery.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
National Machinery & Supply Co., Hamilton, Ont.

Cars, Industrial.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Limited, Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Castings, Aluminum.
Cunningham & Son, St. Catharines, Ont.
Owen Sound Iron Works Co., Ltd., Owen Sound, Ont.
St. Lawrence Foundry, Galt, Ont.
Tallman Brass & Metal Co., Hamilton

Castings, Air Furnaces.
Wm. Tod Company, Youngstown, O.

Castings, Brass.
Cunningham & Son, St. Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.
T. C. Lawrence Foundry, Galt, Ont.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Bronze.
Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton
Wm. Tod Company, Youngstown, O.

Castings, Copper.
Cunningham & Son, St. Catharines, Ont.
Tallman Brass & Metal Co., Hamilton, Ont.

Castings, Gray Iron.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Castings of Ottawa, Ottawa, Ont.
Erie Foundry Co., Erie, Pa.
Alexander Fleck, Ltd., Ottawa.
Gardner, Robt., & Son, Montreal.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.

Castings, Steel Chrome and Manganese Steel.
Electric Steel & Metals Co., Welland.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Wm. Tod Company, Youngstown, O.

Castings, Malleable.
Galt Malleable Iron Co., Galt.

Castings, Nickel Steel.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.

Cement, Disc Wheel.
Gardner Machine Co., Beloit, Wis.

Cement, Iron.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Shelton Metallic Filler Co., Derby, O.

Cement Machinery.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
National Machinery & Supply Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound.

Centre Reamers.
Wells Brothers Co., Greenfield, Mass.

Centering Machines.
John Bertram & Sons Co., Dundas.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.

Centrifugal Pumps.
Can. Buffalo Forge Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
Smart-Turner Machine Co., Hamilton, Ont.

Chain Blocks.
Can. Fairbanks-Morse Co., Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
National Machinery & Supply Co., Hamilton.

Chain Slings.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Chain Clutches.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Chains, Silent and Transmission.
Jones & Glassco, Montreal.
John Millen & Son, Montreal.
Morse Chain Co., Ithaca, N.Y.
Plessisville Foundry, Plessisville, Que.

Chemists.
Toronto Testing Laboratory, Ltd., Toronto.

Chucks, Aero, Automatic.
Garvin Machine Co., New York.

Chucks, Drill, Lathe and Universal.
John Bertram & Sons Co., Dundas, Ont.
Buffalo Forge Co., Buffalo, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Cushman Chuck Co., Hartford, Conn.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Wells Brothers Co., Greenfield, Mass.
Jacobs Mfg. Co., Hartford, Conn.
Ker & Goodwin, Brantford.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford.
National Machinery & Supply Co., Hamilton.
Skinner Chuck Co., New Britain, Conn.
D. E. Whiton Machine Co., New London, Conn.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Chucks, Drill, Automatic and Keyless.
Buffalo Forge Co., Buffalo, N.Y.

Chucks, Ring Wheel.
Gardner Machine Co., Beloit, Wis.

Chucking Machines.
W. P. Davis Machine Co., Rochester, N.Y.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Turner Machine Co., Danbury, Conn.
Warner & Swasey Co., Cleveland, O.

Cinder Mills.
W. W. Sly Mfg. Co., Cleveland, O.

Cleaning Mills.
W. W. Sly Mfg. Co., Cleveland, O.

Cloth and Wool Dryers.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Sheldons, Limited, Galt.

Clutches.
Eastern Machinery Co., New Haven, Conn.
Jones & Glassco, Montreal.
Owen Sound Iron Works Co., Owen Sound.
Positive Clutch & Pulley Works, Ltd., Toronto.

Coal Handling Machinery.
Whiting Foundry Equipment Co., Harvey, Ill.

Coke and Coal.
Hanna & Co., M. A., Cleveland, O.

Collectors, Pneumatic.
Can. Buffalo Forge Co., Montreal.
Sheldons, Limited, Galt.

Compressors, Air.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.
National Machinery & Supply Co., Hamilton.
The Smart-Turner Machine Co., Hamilton.

Concentrating Plant.
Gardner, Robt., & Son, Montreal.

Concrete Mixers.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton.

Concrete Reinforcement.
Canada Wire Goods Mfg. Co., Hamilton.

Condensers.
Can. Buffalo Forge Co., Montreal.
The Smart-Turner Machine Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Consulting Engineers.
Hooper-Falkenau Eng. Co., New York.

Controllers and Starters, Electric Motor.
A. R. Williams Machy. Co., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Conveyors Belt and Screw.
Parkhurst Corporation, Hagerstown, Ind.

Conveyor Machinery.
Can. Fairbanks-Morse Co., Montreal.
Can. Matthews Gravity Carrier Co., Toronto.
National Machinery & Supply Co., Hamilton, Ont.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.

Coping Machines.
Can. Buffalo Forge Co., Montreal.
John Bertram & Sons Co., Dundas.
National Machinery & Supply Co., Hamilton, Ont.
Niles-Bement-Pond Co., New York.

Cornice Brakes.
Brown Boggs Co., Ltd., Hamilton, Canada.
Steel Bending Brake Wks., Chatham.

Counters.
C. J. Root Co., Bristol, Conn.

Counterbores and Countersinks.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wells Bros. Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Countershafts.
Baird Machine Co., Bridgeport, Conn.
Standard Pressed Steel Co., Philadelphia, Pa.
Wells Bros. Co., Greenfield, Mass.

Country House Lighting and Cooking.
Can. Blaugas Co., Montreal.

Couplings.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Eastern Machinery Co., New Haven, Conn.
Gardner, Robt., & Son, Montreal.
Owen Sound Iron Works Co., Owen Sound, Ont.

Couplings, Air Hose.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Crabs, Travelling.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Owen Sound Iron Works Co., Owen Sound.

Cranes, Locomotive.
Northern Crane Works, Walkerville.

Cranes, Gantry.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Goliath.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Cranes, Pneumatic.
Northern Crane Works, Walkerville.
Q. M. S. Co., Chicago, Ill.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Post Jib.
Northern Crane Works, Walkerville.
Q. M. S. Co., Chicago, Ill.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Portable.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Swing Jib.
Northern Crane Works, Walkerville.
Q. M. S. Co., Chicago, Ill.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Transfer.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Wall.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cranes, Travelling Electric and Hand Power.
Dominion Bridge Co., Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Niles-Bement-Pond Co., New York.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Crane, Chain.
Northern Crane Works, Walkerville.

Cranes, All Kinds.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Crank Pin Turning Machine.
Niles-Bement-Pond Co., New York.

Crimps, Leather.
Graton & Knight Mfg. Co., Montreal.

Cupolas.
Can. Buffalo Forge Co., Montreal.
Northern Crane Works, Walkerville.
Sheldons, Ltd., Galt, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Cupola and Blast Gate Blowers.
Can. Sirocco Co., Ltd., Windsor, Ont.

Cupola Blast Gauges & Blowers.
Sheldons, Ltd., Galt, Ont.

Cutters, Angle, Tee Iron and Bar.
Can. Buffalo Forge Co., Montreal.

Cutters, Flue.
Independent Pneumatic Tool Co., Chicago.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Cutters, Pipe.
Can. Fairbanks-Morse Co., Montreal.
A. B. Jardine & Co., Hespeler, Ont.
Trimont Mfg. Co., Roxbury, Mass.

Cutting Compound & Cutting Oil.
Can. Economic Lubricant Co., Montreal.
Commercial Oil Co., Hamilton, Ont
Crescent Oil Co., New York.

Cutter Grinders and Attachments
Cincinnati Milling Machine Co., Cincinnati.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.

Cutters, Milling.
A. R. Williams Machy. Co., Toronto
Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Garvin Machine Co., New York.
Morse Twist Drill and Machine Co., New Bedford.
Tabor Mfg. Co., Philadelphia, Pa.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Cutting-off Machines.
Armstrong Bros. Tool Co., Chicago.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
W. P. Davis Machine Co., Rochester, N.Y.
Earle Gear & Machine Co., Philadelphia, Pa.
Espen Lucas Machine Wks., Philadelphia, Pa.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Geo. Gorton Machine Co., Racine, Wis.
Newton Machine Tool Works, Philadelphia, Pa.
Nutter & Barnes Co., Hinsdale, N.H.
Pratt & Whitney Co., Dundas, Ont.
Q. M. S. Co., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.
L. S. Starrett Co., Athol, Mass.

Damper Regulators.
Can. Fairbanks-Morse Co., Montreal.

Derricks.
Dominion Bridge Co., Montreal.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Designers, Special Machinery.
Baird Machine Co., Bridgeport, Conn.
Hooper-Falkenau Eng. Co., New York.

Dies and Die Stocks.
Armstrong Mfg. Co., Bridgeport, Conn.
Banfield, W. H. & Son, Toronto.
Butterfield & Co., Rock Island, Que.
Brown, Boggs & Co., Hamilton, Ont.
Can. Fairbanks-Morse Co., Montreal.
Duncan Electrical Co., Montreal.
Gardner, Robt., & Son, Montreal.
Greenfield Tap & Die Corporation, Greenfield, Mass.
A. B. Jardine & Co., Hespeler, Ont.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wiley & Russell, Greenfield, Mass.

Dies for Bit Brace Use.
Wells Brothers Co., Greenfield, Mass.

Die Castings.
Tallman Brass & Metal Co., Hamilton

Die Sinkers.
Garvin Machine Co., New York.

Dies for Machines.
Wells Brothers Co., Greenfield, Mass.

Die Sinking Presses, Hydraulic.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Dies, Self-opening.
Duncan Electrical Co., Montreal.
Geometric Tool Co., New Haven.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit

Dies, Opening.
W. H. Banfield & Sons, Toronto.
Can. Fairbanks-Morse Co., Montreal.
Duncan Electrical Co., Montreal.
Greenfield Tap & Die Corporation, Greenfield, Mass.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.

Dies for Screw Plates.
Wells Brothers Co., Greenfield, Mass.

Dies, Sheet Metal Working.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.

Dies, Screws and Thread.
Armstrong Mfg. Co., Bridgeport, Conn.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit.

Discs, Leather.
Graton & Knight Mfg. Co., Montreal.

Draughtsman's Tools.
Emmert Mfg. Co., Waynesboro, Pa.

Draft, Mechanical.
W. H. Banfield & Sons, Toronto.
Butterfield & Co., Rock Island, Que.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Windsor, Ont.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Sheldons, Limited, Galt, Ont.

Drift Bolt Cutters.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drill Presses.
Baker Bros., Toledo, O.
W. F. & John Barnes Co., Rockford.
Can. Buffalo Forge Co., Montreal.
W. P. Davis Machine Co., Rochester, N.Y.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
A. R. Williams Machinery Co., Toronto.

Drilling Machines, Locomotive and Multiple Spindle.
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Colburn Mach. Tool Co., Franklin, Pa.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Niles-Bement-Pond Co., New York.

Drilling Machines, Radial and Turret.
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Motch & Merryweather Machy. Co., Cleveland, O.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Turner Machine Co., Danbury, Conn

Drilling Machines, Sensitive.
Baker Bros., Toledo, O.
W. F. & John Barnes Co., Rockford.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
Rockford Machine Tool Co., Rockford.

Drilling Machines, Upright and Horizontal.
Baker Bros., Toledo, O.
Barnes Drill Co., Rockford, Ill.
Colburn Mach. Tool Co., Franklin, Pa.
W. P. Davis Machine Co., Rochester, N.Y.
Detrick & Harvey Machine Co., Baltimore, Md.
A. R. Williams Machy. Co., Toronto
W. F. & John Barnes Co., Rockford.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler, Ont.
Rockford Machine Tool Co., Rockford.
R. Mellonagall Co., Galt.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

Drilling Posts.
Keystone Mfg. Co., Buffalo, N.Y.

Drills, Bench.
W. F. & John Barnes Co., Rockford.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.
United States Electrical Tool Co. Cincinnati.

Drills, Blacksmith and Bit Stock.
Can. Buffalo Forge Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills, Centre.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill and Machine Co. New Bedford.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills Corner (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Drills, Electric and Portable.
A. R. Williams Machy. Co., Toronto.
Can. Buffalo Forge Co., Montreal.
Niles-Bement-Pond Co., New York.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

Drills, High Speed.
Baker Bros., Toledo, O.
Cleveland Twist Drill Co., Cleveland.
Can. Fairbanks-Morse Co., Montreal.
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill and Machine Co., New Bedford.
W. F. & John Barnes Co., Rockford, Ill.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Drills, Multiple Spindle.
Pratt & Whitney Co., Dundas, Ont.
Niles-Bement-Pond Co., New York.

Drills, Oil Tube.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co. New Bedford.
Wiley & Russell, Greenfield, Mass.

Drills, Pneumatic.
John F. Allen Co., New York.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.
Niles-Bement-Pond Co., New York.

Drills, Ratchet and Hand.
Armstrong Bros. Tool Co., Chicago.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Detroit Twist Drill Co., Detroit, Mich.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Drills, Rock.
A. R. Williams Machy. Co., Toronto.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Drills, Track.
Cleveland Twist Drill Co., Cleveland.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd. Walkerville, Ont.

Drills, Twist.
Armstrong, Whitworth of Canada, Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
John Morrow Screw Co., Ingersoll, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drill Holders.
Wells Brothers Co., Greenfield, Mass.

Drill Sockets.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Drying Appliances.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.

Drying Out Barrels.
Baird Machine Co., Bridgeport, Conn.

Drying Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Dump Cars.
Can. Fairbanks-Morse Co., Montreal.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
National Machinery & Supply Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound.
Plessisville Foundry, Plessisville, Que.

Dust Separators.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Dust Arresters (for Tumbling Mills).
W. W. Sly Mfg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

Dynamos and Electrical Supplies.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo and Motor Co., Ltd., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Electrical Instruments.
Brown Inst. Co., Philadelphia, Pa.

Electrical Supplies.
Duncan Electrical Co., Montreal.

Elevator Enclosures.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Elevating and Conveying Machinery.
Barkey Bros., Stouffville, Ont.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Plessisville Foundry, Plessisville, Que.

Emery Grinders (Pneumatic).
Barkey Bros., Stouffville, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Stow Mfg. Co., Binghamton, N.Y.

Emery and Emery Wheels.
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Hamilton, Ont.
Dom. Abrasive Wheel Co., Toronto.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Stevens, F. B., Detroit, Mich.

Emery Wheels, Dressers and Stands.
Canadian Hart Wheels, Hamilton, Ont.
Dom. Abrasive Wheel Co., Toronto.
Gardner, Robt., & Son, Montreal.
National Machinery & Supply Co. Hamilton, Ont.
Norton Co., Worcester, Mass.

Emery Wheel Safety Flanges.
Canadian Hart Wheels, Hamilton, Ont.

Enameling Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Engines, Corliss, Compound, Pumping.
Wm. Tod Company, Youngstown, O.

Engines, Gas and Gasoline.
Can. Fairbanks-Morse Co., Montreal.
Jones & Glassco, Montreal.
National Machinery & Supply Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Engines, Horizontal and Vertical.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
A. R. Williams Machy. Co., Toronto.
Sheldons, Ltd., Galt, Ont.
Wm. Tod Co., Youngstown, O.

Engines, High-Speed, Automatic.
Can. Buffalo Forge Co., Montreal.

Engines, Steam.
Can. Buffalo Forge Co., Montreal.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.

Engineers, Industrial.
Hooper-Falkenau Eng. Co., New York.

Engineering Books.
The MacLean Publishing Co., Ltd., Toronto.

Engraving Machines.
Geo. Gorton Machine Co., Racine, Wis.

Elevators and Buckets.
Eastern Machinery Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Equipment Shop.
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.
Wm. Tod Co., Youngstown, O.

Escutcheon Pins.
Parmenter & Bulloch Co., Gananoque.

Evaporators' Machinery.
Brown, Boggs & Co., Hamilton, Can.

Exhaust Heads and Hoods.
Can. Buffalo Forge Co., Montreal.
Can. Steel Products Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Exhausters.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.

Experimental Machinery.
Owen Sound Iron Works Co., Owen Sound.

Fans.
Can. Buffalo Forge Co., Berlin, Ont.
Baird Machine Co., Bridgeport, Conn.
Can. Sirocco Co., Ltd., Windsor, Ont.
Plessisville Foundry, Plessisville, Que.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Feed Water Heaters.
Can. Fairbanks-Morse Co., Montreal.
The Smart-Turner Machine Co., Hamilton.

Fence, Iron Factory.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Files.
American Swiss File & Tool Co., New York.
Delta File Works, Philadelphia, Pa.
Nicholson File Co., Port Hope, Ont.

Fire Extinguishers.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Fire Escapes.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works, London, Ont.

Flexible Shafts.
Chicago Flexible Shaft Co., Chicago, Ill.
Stow Mfg. Co., Binghamton, N.Y.

Forges, Hand, etc.
Can. Buffalo Forge Co., Montreal.
Independent Pneumatic Tool Co., Chicago, Ill.
National Machinery & Supply Co., Hamilton.
Sheldons, Limited, Galt, Ont.

Forgings, Drop, Automobile and Locomotive.
Bliss, E. W., Co., Brooklyn, N.Y.
Canadian Billings & Spencer, Ltd., Welland.
J. H. Williams Co., Brooklyn, N.Y.

Forging Hammers, Belt-Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Plessisville Foundry, Plessisville, Que.

Forging Hammers, Steam.
Erie Foundry Co., Erie, Pa.

Forging Ingots.
Electric Steel & Metals Co., Welland.

Forging Machinery.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
National Machinery Co., Tiffin, Ohio.
Plessisville Foundry, Plessisville, Que.
Wm. Tod Company, Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Foundry Engineers.
Hooper-Falkenau Eng. Co., New York.

Foundry Equipment.
Northern Crane Works, Walkerville.
W. W. Sly Mfg. Co., Cleveland, O.
Whiting Foundry Equipment Co., Harvey, Ill.

Friction Leathers.
Graton & Knight Mfg. Co., Montreal.

Friction Clutch Pulleys, etc.
Baird Machine Co., Bridgeport, Conn.
Eastern Machinery Co., New Haven, Conn.
Owen Sound Iron Works Co., Owen Sound.

Furnace Engineers and Contractors.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Oil, Coal, Gas and Electric.
Canadian Hoskins, Limited, Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
W. S. Rockwell Co., New York.
Strong, Carlisle & Hammond, Cleveland, O.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Steel Heating and Brass Melting.
Can. Hoskins, Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
W. S. Rockwell Co., New York.
Strong, Carlisle & Hammond, Cleveland, O.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Heat Treating, Hardening and Tempering.
Can. Hoskins Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
W. S. Rockwell Co., New York.
Strong, Carlisle & Hammond, Cleveland, O.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Forging.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces, Annealing, etc.
Can. Hoskins Ltd., Walkerville, Ont.
Chicago Flexible Shaft Co., Chicago, Ill.
Mechanical Engineering Co., 55 Cote St., Montreal, Que.
W. S. Rockwell Co., New York.
Strong, Carlisle & Hammond, Cleveland, O.
Tate, Jones & Co., Pittsburgh, Pa.
Whiting Foundry Equipment Co., Harvey, Ill.

Furnaces for Baking, Bluing, Drying, Enameling, Japanning and Lacquering.
Oven Equipment & Mfg. Co., New Haven, Conn.

Furnace Lining.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Fuse Cap Machinery.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Gang Planer Tools.
Armstrong Bros. Tool Co., Chicago.

Gaskets, Leather, etc.
Graton & Knight Mfg. Co., Montreal.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Gas Blowers and Exhausters.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Limited, Galt.

Gas Burners.
Oven Equipment & Mfg. Co., New Haven, Conn.

Gas Machines.
Brown, Boggs & Co., Hamilton, Can.

Gas Producer Plants.
Can. Fairbanks-Morse Co., Montreal.

Gauges, Hydraulic Pressure.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Gauges, Standard.
Brown Inst. Co., Philadelphia, Pa.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Holden-Morgan Co., Toronto.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Hartford, Conn.
Garvin Machine Co., New York.
National Machinery & Supply Co., Hamilton.

Gear-Cutting Machinery.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
National Machinery & Supply Co. Hamilton.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.
Sheldons, Limited, Galt, Ont.
The Smart-Turner Machine Co., Hamilton.
Wm. Tod Co., Youngstown, O.
D. E. Whiton Machine Co., New London, Conn.

Gears, Cut, Mortise, Angle, Worm.
Ecol Gear & Machine Co., Philadelphia, Pa.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Hull Iron & Steel Foundries, Ltd., Hull, Quebec.
Jones & Glassco, Montreal, P.Q.
Philadelphia Gear Works, Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.
Wm. Tod Co., Youngstown, O.

Gears, Rawhide.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal, P.Q.
Philadelphia Gear Works, Philadelphia, Pa.
Smart-Turner Machine Co., Hamilton, Ont.

Generators, Electric.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Canadian Westinghouse Co., Hamilton.
Lancashire Dynamo and Motor Co. Ltd., Toronto.
Toronto and Hamilton Electric Co., Hamilton.

Grain for Polishing.
Norton Co., Worcester, Mass.

Grates, Shaking and Dumping.
Erie Foundry Co., Erie, Pa.

Graphite
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Jos. Dixon Crucible Co., Jersey City.
Stevens, F. B., Detroit, Mich.

Gravity Lowering Blocks.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.

Grease Lubriko.
Commercial Oil Co., Hamilton, Ont.

Grinders, Automatic Knife.
W. H. Banfield & Son, Toronto.

Grinders, Centre, Pedestal and Bench.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Ford-Smith Machine Co., Hamilton.
Gray Mfg. & Machine Co., Toronto.
Niles-Bement-Pond Co., New York.
Modern Tool Co., Erie, Pa.
Morse Twist Drill and Machine Co., New Bedford.
New Britain Machine Co., New Britain, Conn.
Norton Grinding Co., Worcester, Mass.
Stow Mfg. Co., Binghamton, N.Y.
United States Electrical Tool Co., Cincinnati, O.

Grinders, Cutter.
Brown & Sharpe Mfg. Co., Providence, R.I.
Greenfield Machine Co., Greenfield, Mass.
Pratt & Whitney Co., Dundas, Ont.

Grinders, Die Chaser.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Landis Machine Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Disk.
Armstrong Bros. Tool Co., Chicago, Ill.
Gardner Machine Co., Beloit, Wis.
Norton Grinding Co., Worcester, Mass.

Grinders, Drill.
Garvin Machine Co., New York.
United States Electric Tool Co., Cincinnati, O.

Grinders, Cylinder, Internal.
Bath Grinder Co., Fitchburg, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Fitchburg Grinder Co., Fitchburg, Mass.
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Norton Grinding Co., Worcester, Mass.
Rivett Lathe & Grinder Co., Boston, Mass.

Grinders, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Grinders, Portable, Electric, Hand, Tool, Post, Floor and Bench.
Baird Machine Co., Bridgeport, Conn.
Bath Grinder Co., Fitchburg, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Fitchburg Grinder Co., Fitchburg, Mass.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Hisey-Wolf Machine Co., Cincinnati, O.
Landis Tool Co., Waynesboro, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Norton Co., Worcester, Mass.
United States Electrical Tool Co., Cincinnati.
A. R. Williams Machy. Co., Toronto.

Grinders, Swing, Portable, Electric.
Hisey-Wolf Machine Co., Cincinnati, O.
United States Electrical Tool Co., Cincinnati.

Grinders, Tool and Holders.
Armstrong Bros. Tool Co., Chicago.
W. F. & John Barnes Co., Rockford, Ill.
Bath Grinder Co., Fitchburg, Mass.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Fitchburg Grinder Co., Fitchburg, Mass.
Greenfield Machine Co., Greenfield, Mass.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
Rivett Lathe & Grinder Co., Boston, Mass.
Tabor Mfg. Co., Philadelphia, Pa.

Grinders, Universal, Plain.
Girard Machine & Tool Co., Philadelphia, Pa.
Landis Tool Co., Waynesboro, Pa.
Modern Tool Co., Erie, Pa.

Grinders, Vertical Surface.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Pratt & Whitney Co., Dundas, Ont.

Grinding and Polishing Machines, Portable, Pneumatic and Spring Frame.
Bath Grinder Co., Fitchburg, Mass
Can. Fairbanks-Morse Co., Montreal.
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Fitchburg Grinder Co., Fitchburg, Mass.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Gray Mfg. & Machine Co., Toronto.
Greenfield Machine Co., Greenfield, Mass.
Hall & Sons, John H., Brantford.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Independent Pneumatic Tool Co., Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Norton Co., Worcester, Mass.
Stow Mfg. Co., Binghamton, N.Y.

Grinding Machines (Railroading).
Newton Machine Tool Works, Philadelphia, Pa.

Grinding Wheels.
Can. Fairbanks-Morse Co., Montreal
Canadian Hart Wheels, Ltd., Hamilton, Ont.
Carborundum Co., Niagara Falls.
Dom. Abrasive Wheel Co., Toronto.
Ford-Smith Machine Co., Hamilton, Canada.
Gray Mfg. & Machine Co., Toronto.
Norton Co., Worcester, Mass.

Guards, Window and Machine.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Hack Saw Blades.
Victor Saw Works, Ltd., Hamilton, Canada.
Diamond Saw & Stamping Works, Buffalo, N.Y.
L. S. Starrett Co., Athol, Mass.

Hack Saw Frames.
Ford-Smith Machine Co., Hamilton, Canada.
Garvin Machine Co., New York City.
Mussens, Limited, Montreal.

Hammer High Speed.
High Speed Hammer Co., Rochester, N.Y.

Hammers, Drop and Belt Driven.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton Canada.
Canadian Billings & Spencer, Ltd., Welland.
A. B. Jardine & Co., Hespeler, Ont.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.
Plessisville Foundry, Plessisville, Que
Toledo Machine & Tool Co., Toledo.

Hammers, Helve Power.
West Tire Setter Co., Rochester, N.Y.

Hammers, Pneumatic.
Independent Pneumatic Tool Co., Chicago, Ill.
Cleveland Pneumatic Tool Co., of Canada, Toronto.

Hammers (Rawhide).
Chicago Rawhide Mfg. Co., Chicago Ill.

Hammers, Steam.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machinery & Supply Co., Hamilton.
Niles-Bement-Pond Co., New York.

Hand Hoists & Trolleys.
Whiting Foundry Equipment Co., Harvey, Ill.

Hand Leathers or Pads.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Montreal.

Hangers.
Baird Machine Co., Bridgeport, Conn.
Gardner, Robt., & Son, Montreal.
The Smart-Turner Machine Co., Hamilton.
Standard Pressed Steel Co., Philadelphia, Pa.

Hardness Testing Instruments.
Shore Instrument & Mfg. Co., New York.

Heating and Ventilating Engineers.
Can. Buffalo Forge Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Hooper-Falkenau Eng. Co., New York.
Sheldons, Ltd., Galt, Ont.

Heat Gauges, Hardening and Annealing.
Shore Instrument & Mfg. Co., New York.

Hinge Machinery.
Baird Machine Co., Bridgeport, Conn.

Hinges.
London Bolt & Hinge Works, London, Ont.

Hoists, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Hoisting and Conveying Machinery.
Northern Crane Works, Walkerville.
Owen Sound Iron Works Co., Owen Sound.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Chain, Electric and Pneumatic.
Northern Crane Works, Walkerville.
Vulcan Engineering Sales Co., Chicago, Ill.
Whiting Foundry Equipment Co., Harvey, Ill.

Hoists, Electric.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Hose Clamp Tool.
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Hose, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Hose, Steam, Suction and Water.
Can. H. W. Johns-Manville Co., Limited, Toronto.

Holders for Dies and Drills.
Wells Brothers, Company, Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Hydraulic Accumulators.
Can. Boomer & Boschert Press Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.
The Smart-Turner Machine Co., Hamilton.
Watson-Stillman Co., Aldene, N.J.

Hydraulic Machinery.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago.
Niles-Bement-Pond Co., New York.
John Inglis Co., Toronto.
National Machinery & Supply Co., Hamilton.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood Co., Philadelphia, Pa.

Indicators, Speed.
Brown Inst. Co., Philadelphia, Pa.
Brown & Sharpe Mfg. Co., Providence, R.I.
L. S. Starrett Co., Athol, Mass.

Index Centres.
Garvin Machine Co., New York.

Industrial Engineers.
Hooper-Falkenau Eng. Co., New York.

Ingot Metals.
M. & L. Samuel, Benjamin & Co., Toronto.

Iron Filler.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Iron Ore.
Hanna & Co., M. A., Cleveland, O.

Jacks, Hydraulic
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N. J.

Jacks.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Norton, A. O., Coaticook, Que.
Plessisville Foundry, Plessisville, Que

Jacks, Pneumatic.
Northern Crane Works, Walkerville.

Jacks, Pit and Track.
Can. Fairbanks-Morse Co., Montreal.
Northern Crane Works, Walkerville.
Watson-Stillman Co., Aldene, N.J.

Japanning Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Jaws, Face Plate.
Cushman Chuck Co., Hartford, Conn.
Skinner Chuck Co., New Britain, Conn.

Jigs, Tools, etc.
Hamilton Gear & Machine Co., Toronto.

Key Seaters.
Baker Bros., Toledo, O.
W. P. Davis Machine Co., Rochester, N.Y.
Garvin Machine Co., New York.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Machine Tool Works, Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.

Kilns.
Can. Buffalo Forge Co., Montreal.
Sheldons, Limited, Galt, Ont.

Lacquering Ovens.
Oven Equipment & Mfg. Co., New Haven, Conn.

Lacing, Belt.
Chicago Rawhide Mfg. Co., Chicago, Ill.

Ladles, Foundry.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Lag Screw Gimlet Pointers.
National Machy. Co., Tiffin, Ohio.

Lamps, Arc and Incandescent.
Can. Fairbanks-Morse Co., Montreal.
Can. H. W. Johns-Manville Co., Limited, Toronto.
Ker & Goodwin, Brantford.

Lathe Chucks.
Ker & Goodwin, Brantford.

Lathe Attachment for Shells.
Lymburner, Ltd., Montreal.

Lathes, Automatic.
Windsor Machine Co., Windsor, Vt.

Lathe Dogs and Attachments.
Armstrong Bros. Tool Co., Chicago.
Bridgeford Machine Tool Works, Rochester, N.Y.
Fay & Scott, Dexter, Maine.
Hendey Machine Co., Torrington, Conn.
J. H. Williams Co., Brooklyn, N.Y.

Lathes, Bench.
W. F. & John Barnes Co., Rockford.
Blount, J. G., & Co., Everett, Mass.
Can. Fairbanks-Morse Co., Montreal.
Pratt & Whitney Co., Dundas, Ont.

Lathes, Engine.
A. R. Williams Machy. Co., Toronto.
Barnes Drill Co., Rockford, Ill.
W. F. & John Barnes Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Bridgeford Machine Tool Works, Rochester, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Iron & Steel Co., Cincinnati, O.
W. P. Davis Machine Co., Rochester, N.Y.
Fay & Scott, Dexter, Maine.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Hendey Machine Co., Torrington, Conn.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
R. McDougall Co., Galt.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rahn-Larmon Co., Cincinnati, O.

Lathes, Extension Gap.
Barnes Drill Co., Rockford, Ill.

Lathe Pans.
New Britain Machine Co., New Britain, Conn.

Lathes, Patternmakers'.
J. G. Blount Co., Everett, Mass.
Fay & Scott, Dexter, Maine.
Mussens, Limited, Montreal.

Lathes, Screw Cutting.
A. R. Williams Machy. Co., Toronto.
Barnes Drill Co., Rockford, Ill.
John Bertram & Sons Co., Dundas.
Cincinnati Iron & Steel Co., Cincinnati, O.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.

Lathes, Spinning.
Bliss, E. W., Co., Brooklyn, N.Y.
Toledo Mach. & Tool Co., Toledo, O.

Lathe, Turret and Speed.
Acme Machine Tool Co., Cincinnati, O.
John Bertram & Sons Co., Dundas.
Blount, J. G., & Co., Everett, Mass.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Cincinnati Iron & Steel Co., Cincinnati, O.
Gallup Machine Tool Co., Frankun, Pa.
W. P. Davis Machine Co., Rochester.
Fay & Scott, Dexter, Maine.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co. Cleveland, O.
New Britain Machine Co., New Britain, Conn.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rahn-Larmon Co., Cincinnati, O.
A. O. Walworth & Co., Chicago, Ill.
Warner & Swasey Co., Cleveland, O.
Windsor Machine Co., Windsor, Vt.
A. R. Williams Machy. Co., Toronto.

Leather, Cup.
Chicago Rawhide Mfg. Co., Chicago, Ill.

Leather, Pump, Valve, Hydraulic, Etc.
Chicago Rawhide Mfg. Co., Chicago, Ill.

Leather Strapping.
Graton & Knight Mfg. Co., Montreal.

Lifts, Pneumatic.
Whiting Foundry Equipment Co., Harvey, Ill.

Link Belting.
Can. Fairbanks-Morse Co., Montreal.
Graton & Knight Mfg. Co., Montreal.
Jones & Glassco, Montreal.

Linoleum Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.

Liquid Air.
L'Air Liquide Society, Montreal, Toronto.

Lockers, Steel Wardrobe and Steel Material.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Lockers.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Locomotive Equipment.
Can. Locomotive Co., Kingston, Ont.

Locomotives, Railroading, Contracting.
Can. Locomotive Co., Kingston, Ont.
National Machinery & Supply Co., Hamilton.

Locomotives, Turn Tables.
Can. Bridge Co., Walkerville, Ont.

Lubricants.
Can. Economic Lubricant Co., Montreal.
Cataract Refining Co., Toronto.
Commercial Oil Co., Hamilton, Ont.

Machine Divided Rules.
Lufkin Rule Co., Saginaw, Mich.

Machine Tools.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal.
Modern Tool Co., Erie, Pa.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Machinery Dealers.
Can. Fairbanks-Morse Co., Montreal.
National Machinery & Supply Co., Hamilton.
A. R. Williams Machy. Co., Toronto

Machinery Guards.
Jones & Glassco, Montreal, P.Q.
Canada Wire & Iron Goods Co., Hamilton, Ont.
A. R. Williams Machy. Co., Toronto.

Machinery Repairs.
Cunningham & Sons, St. Catharines, Ont.
Plessisville Foundry, Plessisville, Que.

Machinists' Scales, Small Tools and Supplies.
Can. Fairbanks-Morse Co., Montreal.
Frank H. Scott, Montreal.
J. H. Williams & Co., Brooklyn, N.Y.

Mandrels.
Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill and Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Marine Engines.
Cunningham & Sons, St. Catharines, Ont.

Marking Machinery.
Holden-Morgan Co., Toronto.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Marquises.
Dennis Wire & Iron Works, London, Ont.

Measuring Tapes and Rules.
James Chesterman & Co., Ltd., Sheffield, Eng.
Lufkin Rule Co., of Canada, Windsor, Ont.

Mechanical Engineers.
Hooper-Falkenau Eng. Co., New York.

Metallurgists.
Toronto Testing Laboratory, Ltd., Toronto.

Metal Cutting Machines.
Racine Tool & Machine Co., Racine, Wis.

Metal Stamping.
Duncan Electrical Co., Montreal.

Meters, Electrical.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Mill Machinery.
Cunningham & Sons, St Catharines, Ont.
Alexander Fleck, Ltd., Ottawa.

Milling Attachments.
John Bertram & Sons Co., Dundas.
Brown & Sharpe Mfg. Co., Providence.
Cincinnati Milling Machine Co., Cincinnati.
Hendey Mach. Co., Torrington, Conn.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co. Milwaukee, W.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Horizontal and Vertical.
A. R. Williams Machy. Co., Toronto.
Brown & Sharpe Mfg. Co., Providence.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
John Bertram & Sons Co., Dundas.
Girard Machine & Tool Co., Philadelphia, Pa.
Gooley & Edlund, Cortland, N.Y.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, W.
Motch & Merryweather Machy. Co., Cleveland, O.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Crescent Oil Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.

Milling Machines, Keyseat.
Newton Machine Tool Works, Philadelphia, Pa.

Milling Machines, Multiple Spindle, Duplex, Etc.
Newton Machine Tool Works, Philadelphia, Pa.

Milling Machines, Plain, Bench and Universal.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cincinnati Milling Machine Co., Cincinnati.
Garvin Machine Co., New York.
Gooley & Edlund, Cortland, N.Y.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
Hendey Machine Co., Torrington.
Kearney & Trecker Co., Milwaukee.
Kempsmith Mfg. Co., Milwaukee, Wis.
Motch & Merryweather Machy. Co., Cleveland, O.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Rockford Milling Machine Co., Rockford, Ill.
A. R. Williams Machy. Co., Toronto.

Milling Machines, Profile.
Brown & Sharpe Mfg. Co., Providence.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Motch & Merryweather Machy. Co., Cleveland, O.
Pratt & Whitney Co., Dundas, Ont.

Milling Tools.
Brown & Sharpe Mfg. Co., Providence.
Geometric Tool Co., New Haven, Conn.
Kempsmith Mfg. Co., Milwaukee, W.

Mine Cars and Hitchings.
Pratt & Whitney Co., Dundas, Ont.
Modern Tool Co., Erie, Pa.
Can. Fairbanks-Morse Co., Montreal.

Mining Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Mortising Machines.
Jones & Glassco, Montreal.

Motors, Electric.
A. R. Williams Machy. Co. Toronto.
Can. Fairbanks-Morse Co., Montreal.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Motors, Pneumatic.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Multiple Index Centres.
Garvin Machine Co., New York.

Nipple Threading Machines.
John H. Hall & Sons, Ltd., Brantford, Ont.
Landis Machine Co., Waynesboro, Pa.

Nitrogen.
L'Air Liquide Society, Montreal, Toronto.

Nozzles, Spray.
Can. Buffalo Forge Co., Montreal.

Nuts, Semi-Finish and Finished.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll Ont.

Nut Burring Machines.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Machines (Hot).
National Machy. Co., Tiffin, O.

Nut Facing and Bolt Shaving Machines.
Garvin Machine Co., New York.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Tappers.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Hall, J. H., & Son, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
National Machy. Co., Tiffin, O.
National Mach. & Sup. Co., Hamilton

Nut Wrenches.
Wells Brothers Co., Greenfield, Mass.

Oil Separators.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.
Smart-Turner Machine Co., Hamilton, Ont.

Oil Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

Oils, Lubricating, Tempering.
Commercial Oil Co., Hamilton, Ont.

Ovens for Baking, Bluing, Drying, Enamelling, Japanning, and Lacquering.
Geo. Gorton Machine Co., Racine, Wis.
Oven Equipment & Mfg. Co., New Haven, Conn.
Whiting Foundry Equipment Co., Harvey, Ill.

Oven Trucks, Steel.
Oven Equipment & Mfg. Co., New Haven, Conn.

Ovens for Drying, Temper and Under Trucks.
Oven Equipment & Mfg. Co., New Haven, Conn.

Oscillating Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.

Oxy-Acetylene Welding and Cutting Plants.
L'Air Liquide Society, Montreal, Toronto.

Oxygen.
L'Air Liquide Society, Montreal, Toronto.

Packings, Leather, Hydraulics, Etc.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Montreal.

Packing, Rubber, etc.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Pans, Lathe.
Cleveland Wire Spring Co., Cleveland

Pans, Steel Shop.
Cleveland Wire Spring Co., Cleveland

Paper Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.
Can. Sirocco Co., Ltd., Windsor, Ont.

Partitions.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Patent Solicitors.
H. J. S. Dennison, Toronto.
Fetherstonhaugh & Co., Ottawa.
Marion & Marion, Montreal.
Ridout & Maybee, Toronto.
Ross Thomson & Co., Ottawa, Ont.

Patterns.
Galt Malleable Iron Co., Galt.
Guelph Pattern Works, Guelph.
Hamilton Pattern & Foundry Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound, Ont.
Plessisville Foundry, Plessisville, Que.
Toronto Pattern Works, Toronto.
Wells Pattern & Machine Works, Toronto.

Patterns, Metal and Wood.
Guelph Pattern Works, Guelph, Ont.

Perforated Metals and Ornamental Iron Goods.
Canada Wire & Iron Goods Co., Hamilton.

Penstocks.
Polson Iron Works, Toronto.

Phosphor Bronze Castings.
Tallman Brass & Metal Co., Hamilton.

Pig Iron.
Hanna & Co., M. A., Cleveland, O.
Stevens, F. B., Detroit, Mich.

Pinions, Mill Cut.
Wm. Tod Co., Youngstown, O.

Pipe Cutting and Threading Machines.
A. R Williams Machy. Co., Toronto.
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
Butterfield & Co., Rock Island ,Que.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
John H. Hall & Sons, Brantford.
A. B. Jardine & Co., Hespeler, Ont.
Landis Machine Co., Waynesboro. Pa.
R. McDougall Co., Galt.
Tolmont Mfg. Co., Roxbury, Mass.
Williams Tool Co., Erie, Pa.

Pipe Cutters, Rolling.
Armstrong Mfg. Co., Bridgeport, Conn.
Bignall & Keeler Mfg. Co., Edwardsville, Ill.
John H. Hall & Sons, Ltd., Brantford, Ont.

Pipe Straightening Machines.
Watson-Stillman Co., Aldene, N.J.

Planer Drives, Electrical.
Lancashire Dynamo & Motor Co., Ltd., Toronto.
Niles-Bement-Pond Co., New York.

Planer Jacks.
Armstrong Bros. Tool Co., Chicago.

Planers, Standard and Rotary.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt., & Son, Montreal.
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Morton Mfg. Co., Muskegon Heights, Mich.
Newton Machine Tool Works, Philadelphia, Pa.
Niles-Bement-Pond Co., New York.

Planing and Shaping Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co, Montreal.
Detrick & Harvey Machine Co., Baltimore, Md.
Fay & Scott, Dexter, Maine.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.

Planing Mill Exhausters.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Pliers.
Canadian Billings & Spencer, Ltd., Welland.
McKaig Drop Forge Co., Buffalo, N.Y.

Pneumatic Tools.
Cleveland Pneumatic Tool Co of Canada, Toronto.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Independent Pneumatic Tool Co, Chicago, New York.

Polishing Machines, Electric and Band.
Can. H. W. Johns-Manville Co., Toronto.

Portable Vise Stands.
New Britain Machine Co., New Britain, Conn.

Portable Steel Tool Racks.
New Britain Machine Co., New Britain, Conn.

Portable Steel Work Stands.
New Britain Machine Co., New Britain, Conn.

Power Plant Engineers.
Hooper-Falkenau Eng. Co., New York.

Power Plant Equipments.
Can. Fairbanks-Morse Co., Montreal.

Power Transmission.
The Smart-Turner Mach. Co., Hamilton.

Press Screw (Adjustable).
W. F. & John Barnes Co., Rockford.

Presses, Bench Straightening
Toledo Machine & Tool Co., Toledo.

Presses for Shells.
Can. Boomer & Boschert Press Co Montreal
Can. Locomotive Co., Kingston, Ont.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
Charles F. Elmes Eng. Works, Chicago
Goldie & McCulloch Co., Galt, Ont.
Watson-Stillman Co., Aldene, N.J.
West Tire Setter Co., Rochester, N.Y.
R. D. Wood Co., Philadelphia, Pa.

Presses, Cam, Toggle, Eyelet.
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo, O.

Presses, Broaching.
E. W. Bliss Co., Brooklyn, N.Y.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman & Co., Aldene, N.J.

Presses, Drop
W. H. Banfield & Son, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Boomer & Boschert Press Co., Montreal.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.

Presses, Filter.
Lymburner, Ltd., Montreal.

Presses, Forging.
Can. Boomer & Boschert Press Co., Montreal.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
Charles F. Elmes Eng. Works, Chicago, Ill.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Wm. Tod Co., Youngstown, O.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.

Presses, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Wm. Cramp & Sons Ship & Engine Building Co., Philadelphia, Pa.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Charles F. Elmes Eng. Works, Chicago, Ill.
Hydraulic Press Co., Mt. Gilead.
Niles-Bement-Pond Co., New York.
Wm. Tod Company, Youngstown, O
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood Co., Philadelphia, Pa.

Presses, Pneumatic.
Toledo Machine & Tool Co., Toledo.

Presses, Power.
Baird Machine Co., Bridgeport, Conn.
Can. Boomer & Boschert Press Co., Montreal.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Can. Fairbanks-Morse Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Geo. Gorton Machine Co., Racine.
Girard Machine & Tool Co., Philadelphia, Pa.
Toledo Machine & Tool Co., Toledo.
Watson-Stillman Co., Aldene, N.J.
A. R. Williams Machy. Co., Toronto.

Presses, Scrap Baling.
Can. Boomer & Boschert Press Co., Montreal.
Watson-Stillman Co., Aldene, N.J.

Presses, Spring Foot.
Baird Machine Co., Bridgeport, Conn.
Toledo Machine & Tool Co., Toledo.
Brown, Boggs & Co., Hamilton, Can.

Presses, Screw.
Can. Boomer & Boschert Press Co., Montreal.

Pressure Regulators.
Can. Fairbanks-Morse Co., Montreal.

Protective Paint.
Jos. Dixon Crucible Co., Jersey City.

Pulleys.
Baird Machine Co., Bridgeport, Conn.
Brown & Sharpe Mfg. Co., Providence, R.I.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Positive Clutch & Pulley Works, Ltd., Toronto.
The Smart-Turner Mach. Co., Hamilton.

Pulley Machinery, Drilling and Tapping.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.

Pumps, High Pressure.
Charles F. Elmes Eng. Works, Chicago
Watson-Stillman Co., Aldene, N.J.

Pumping Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
The Smart-Turner Mach. Co., Hamilton.
Wm. Tod Company, Youngstown, O.

Pumps, all Kinds.
Can. Buffalo Forge Co., Montreal.
Charles F. Elmes Eng. Works, Chicago
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
Owen Sound Iron Works Co., Owen Sound
The Smart-Turner Mach. Co., Hamilton.
A. R. Williams Machy. Co., Toronto.
Watson-Stillman Co., Aldene, N.J.
Wayne Oil Tank & Pump Co., Fort Wayne.

Pumps, Electrically Driven.
D'Olier Centrifugal Pump & Mach. Co., Philadelphia, Pa.
The Smart-Turner Mach. Co., Hamilton.

Pumps, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal
Charles F. Elmes Eng. Works, Chicago, Ill.
Wm. Tod Co., Youngstown, O.
Watson-Stillman Co., Aldene, N.J.

Pumps, Steam.
Wm. Tod Company, Youngstown, O.

Pump Leathers.
Graton & Knight Mfg. Co., Montreal.

Punches and Dies.
W. H. Banfield & Sons, Toronto.
E. W. Bliss Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Scott Bros., Halifax, Eng.
Gardner, Robt., & Son, Montreal.
Globe Machine & Stamping Co.
A. B. Jardine & Co., Hespeler, Ont.
Pratt & Whitney Co., Dundas, Ont.
Toledo Machine & Tool Co., Toledo, O.
A. O. Walworth & Co., Chicago, Ill.

Punches, Power.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Girard Machine & Tool Co., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.
A. O. Walworth & Co., Chicago, Ill

Punches, Pneumatic.
Jno. F. Allen Co., New York.

Punching Machines, Horizontal.
Bertrams, Ltd., Edinburgh, Scotland.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs Co., Ltd., Hamilton, Canada.
Long & Alstatter Co., Hamilton Ohio.
Niles-Bement-Pond Co., New York.

Pyrometers.
Brown Instrument Co., Philadelphia, Pa.
Canadian Hoskins, Limited, Walkerville, Ont.
Shore Instrument & Mfg. Co., New York City.
Thwing Instrument Co., Philadelphia, Pa.

Quartering Machines.
John Bertram & Sons Co., Dundas.
Niles-Bement-Pond Co., New York.

Ratchet Wrenches.
Wells Brothers Co., Greenfield, Mass.

Railing, Iron and Brass.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Rail Benders.
Niles-Bement-Pond Co., New York.

Railroad Tools.
Can. Fairbanks-Morse Co., Montreal.
Niles-Bement-Pond Co., New York.

Railroad Tools, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Rammers, Bench and Floor.
Guelph Pattern Works, Guelph, Ont.

Rapping Plates.
Stevens, F. B., Detroit, Mich.

Ratchets.
Keystone Mfg. Co., Buffalo, N.Y.

Raw Hide Pinions.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Gardner, Robt., & Son, Montreal.
Hamilton Gear & Machine Co., Toronto.
Jones & Glassco, Montreal.
Smart-Turner Machine Co., Hamilton, Ont.

Reamers, Adjustable.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland
Detroit Twist Drill Co., Detroit, Mich.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wells Brothers Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.

Reamers, Bridge, Expanding and High Speed.
Butterfield & Co., Rock Island, Que
Can. Fairbanks-Morse Co., Montreal
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Reamer Fluting Machines.
Garvin Machine Co., New York.

Reamers, Pipe, Cylinder and Locomotive.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Reaming Machines, Pneumatic.
Cleveland Pneumatic Tool Co., of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago.

Reamers, Steel Taper and Self-Feeding.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Twist Drill Co., Cleveland.
A. B. Jardine & Co., Hespeler, Ont.
Morse Twist Drill & Machine Co., New Bedford.
Pratt & Whitney Co., Dundas, Ont.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Rebuilt Machine Tools.
New York Machy. Co., New York.

Reels.
Baird Machine Co. Bridgeport, Conn.
Wilt Twist Drill Co., of Canada, Ltd., Walkerville, Ont.

Revolution Indicators and Recorders.
Brown Instrument Co., Philadelphia, Pa.

Rheostats.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Rivet Machines.
Buffalo Forge Co., Buffalo, N.Y.
National Machinery Co., Tiffin, O.

Rivets, Tubular, Bifurcated.
Parmenter & Bulloch Co., Gananoque.

Rivets, Iron, Copper and Brass.
Parmenter & Bulloch Co., Gananoque.

Riveters, Pneumatic, Hydraulic. Hammer, Compression.
Jno. F. Allen Co., New York.
Can. Fairbanks-Morse Co., Montreal.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co. of Chicago, Ill.
National Mach. & Sup. Co., Hamilton
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Riveting Machines, Elastic Rotary Blow.
Girard Machine & Tool Co., Philadelphia, Pa.
High-Speed Hammer Co., Rochester, N.Y.
F. B. Shuster Co., New Haven, Conn.

Rolls, Bending.
John Bertram & Sons Co., Dundas, Ont
Brown, Boggs Co., Ltd., Hamilton, Canada.
Niles-Bement-Pond Co., New York.
Toledo Machine & Tool Co., Toledo.

Rolling Mill Machinery.
Wm. Tod Co., Youngstown, O.

Roofing.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Rotary Converters.
A. R. Williams Machy. Co., Toronto
Toronto and Hamilton Electric Co., Hamilton.

Rubber Mill Machinery.
Bertrams, Ltd., Edinburgh, Scotland.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Rules.
Brown & Sharpe Mfg. Co., Providence, R.I.
James Chesterman & Co., Ltd., Sheffield, Eng.
L. S. Starrett Co., Athol, Mass.

Safety Set Screws.
Allen Mfg. Co., Inc., Hartford, Conn.

Sand Blasts.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Gray Mfg. & Machine Co., Toronto.
W. W. Sly Mfg. Co., Cleveland, O.

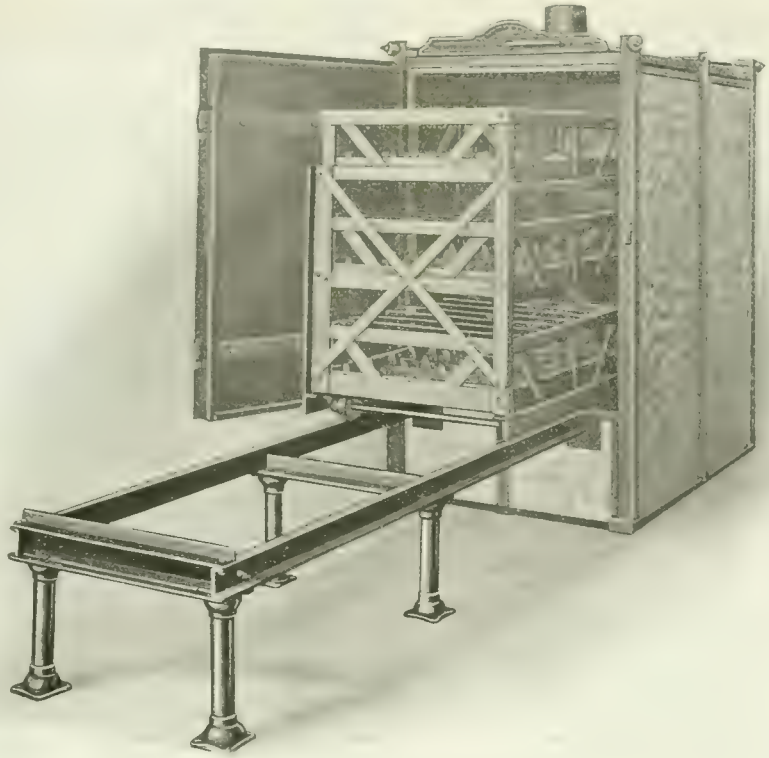
Saw Blades.
Diamond Saw & Stamping Works, Buffalo, N.Y.
Huther Bros. Saw Mfg. Co., Rochester, N.Y.

Saw Tables.
Hub Machine Welding & Contracting Co., Philadelphia, Pa.

Saw Sharpening Machines.
Nutter & Barnes Co., Hinsdale, N.H.

Saw Mill Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Gardner, Robt. & Son, Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Espen-Lucas Machine Works, Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
Plessisville Foundry, Plessisville, Que.

Sawing Machines, Cold Metal.
Newton Machine Tool Works, Philadelphia, Pa.



Another type of Crawford Sectional Oven used in baking the varnish or finish on Shrapnel and High Explosive Shells to prevent corrosion.

All ovens are equipped with enclosed flame gas burners which protect the coating to be baked from coming in direct contact with the flame. Either city, natural, gasoline or producer gas can be used with this equipment.

By the above method of burning the gas and at the same time providing the necessary circulation of air in the oven through the use of a positive pressure blower, we support combustion of the gas within the generator by confining the gas and air, thereby obtaining perfect combustion and all of the heat units from the gas with no by-products to affect the smoothness or texture of the coating.

The truck shown with this oven is designed with three independent racks, each holding thirty-five, thirty-four-pound shells, about five inches diameter, and fourteen inches long,—each rack being run into the truck separately and loaded, total load being one hundred and five shells,—ovens and trucks built for any number or size of shells required.

The Oven Equipment & Manufacturing Company

NEW HAVEN, CONN.

Canadian Representatives: THE A. R. WILLIAMS MACHINERY CO., LIMITED, TORONTO, CANADA

Saws, High-Speed, Friction.
Espen Lucas Machine Works, Philadelphia, Pa.
Earle Gear & Machine Co., Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa.
Nutter & Barnes Co., Hinsdale, N.H.

Saws, Inserted Tooth.
Earle Gear & Machine Co., Philadelphia, Pa.
Espen-Lucas Machine Works, Philadelphia, Pa.
Huther Bros. Saw Mfg. Co., Rochester, N.Y.
Q. M. S. Co., Chicago, Ill.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hack.
Can. Fairbanks-Morse Co., Montreal.
Diamond Saw & Stamping Works, Buffalo.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
L. S. Starrett Co., Athol, Mass.

Saws, Circular Metal.
Earle Gear & Machine Co., Philadelphia, Pa.
Espen-Lucas Machine Works, Philadelphia, Pa.
Hub Machine Welding & Contracting Co., Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa.
Huther Bros. Saw Mfg. Co., Rochester, N.Y.
Tabor Mfg. Co., Philadelphia, Pa.

Saws, Hot and Cold.
Earle Gear & Machine Co., Philadelphia, Pa.
Hunter Saw & Machine Co., Pittsburg, Pa.
Huther Bros. Saw Mfg. Co., Rochester, N.Y.
Nutter & Barnes Co., Hinsdale, N.H.
Q. M. S. Co., Chicago, Ill.
Vulcan Eng. Sales Co., Chicago, Ill.

Scleroscopes.
Shore Instrument & Mfg. Co., New York City.

Screws, Caps and Set.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll, Ont.

Screw Machine Products.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll, Ont.

Screw Machines, Hand, Automatic.
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R.I.
Can. Fairbanks-Morse Co., Montreal
Garvin Machine Co., New York.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co., of Chicago, Chicago, Ill.
A. R. Jardine & Co., Hespeler.
Motch & Merryweather Machy. Co., Cleveland, O.
National Mach. & Sup. Co., Hamilton.
New Britain Machine Co., New Britain, Conn.
Pratt & Whitney Co., Dundas, Ont.
A. O. Walworth & Co., Chicago, Ill.
Warner & Swasey Co., Cleveland, O.
A. R. Williams Machy. Co., Toronto.
Windsor Machine Co., Windsor, Vt.

Screw Machines, Multiple Spindle.
New Britain Machine Co., New Britain, Conn.
Windsor Machine Co., Windsor, Vt.

Screw Plates.
Butterfield & Co., Rock Island, Que.
Can. Tap & Die Co., Galt, Ont.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Wells Brothers Co., Greenfield, Mass.
Wiley & Russell Co., Greenfield, Mass.

Screw Slotters.
Garvin Machine Co., New York.
Pratt & Whitney Co., Dundas, Ont

Set Screws, Safety.
Allen Mfg. Co., Hartford, Conn.

Second-Hand Machinery.
New York Machinery Co., New York.
Gardner, Robt. & Son, Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Gardner, Robt. & Son, Montreal
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton
Union Drawn Steel Co., Hamilton.

Shanks, Straight and Taper.
Jacobs Mfg. Co., Hartford, Conn.

Shapers.
John Bertram & Sons Co., Dundas.
Can. Fairbanks-Morse Co., Montreal.
W. P. Davis Machine Co., Rochester, N.Y.
Gardner, Robt., & Son, Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
Hendey Machine Co., Torrington, Ct.
Hill, Clarke & Co., of Chicago, Chicago, Ill.

Shafting.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Newton Machine Tool Works, Inc., Philadelphia, Pa.
Niles-Bement-Pond Co., New York.
Pratt & Whitney Co., Dundas, Ont.
Stockbridge Machine Co., Worcester, Mass.

Sharpening Stones.
Carborundum Co., Niagara Falls, N.Y.
Norton Co., Worcester, Mass.

Shavings, Separators.
Can. Buffalo Forge Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Shearing Machines, Angle Iron, Bar and Gate.
John Bertram & Sons Co., Dundas.
Bertrams, Ltd., Edinburgh, Scotland.
Girard Machine & Tool Co., Philadelphia, Pa.
A. B. Jardine & Co., Hespeler.
Long & Alstatter, Hamilton, Ohio.
Niles-Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
Toledo Machine & Tool Co., Toledo.

Shears, Power.
John Bertram & Sons Co., Dundas.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown Boggs Co., Ltd., Hamilton, Canada.
Buffalo Forge Co., Buffalo, N.Y.
Girard Machine & Tool Co., Philadelphia, Pa.
National Machy. Co., Tiffin, Ohio.
National Mach. & Sup. Co., Hamilton.
Niles-Bement-Pond Co., New York.
Scott Bros., Halifax, Eng.
Toledo Machine & Tool Co., Toledo.

Shears, Lever, Hydraulic.
Watson-Stillman Co., Aldene, N.J.

Shears, Pneumatic.
John F. Allen Co., New York.
Toledo Machine & Tool Co., Toledo, Ohio.

Shears, Squaring.
Brown, Boggs, & Co., Hamilton, Can.

Sheet Steel.
Dom. Sheet Metal Co., Hamilton, Ont.

Sheet Metal Working Tools.
Baird Machine Co., Bridgeport, Conn.
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont

Sheet Metal Stampings.
Duncan Electrical Co., Montreal.

Shell Banding Machines, Hydraulic.
Can. Locomotive Co., Kingston, Ont.
Lymburner, Ltd., Montreal.
Motch & Merryweather Machy. Co., Cleveland, O.
Watson-Stillman Co., Aldene, N.J.
West Tire Setter Co., Rochester, N.Y.

Shell Painting Machine.
Can. Locomotive Co., Kingston, Ont.

Shell Screws, Headless.
Blake & Johnson, Waterbury, Conn.

Shelving, Steel Partitions.
Canadian Steel Products Company, Montreal.

Shrapnel Shell Forging, Drilling Machines.
Barnes Drill Co., Rockford, Ill.

Shrapnel Shell Marker.
Brown-Boggs Co., Hamilton, Ont.
Holden Morgan Co., Toronto
Noble & Westbrook Mfg. Co., Hartford, Conn.
Pangborn Corporation, Hagerstown, Md.

Shrapnel Sand Blasts.
Pangborn Corporation, Hagerstown, Md.
W. W. Sly Mfg. Co., Cleveland, O.

Side Tools.
Armstrong Bros. Tool Co., Chicago.

Slotters.
Garvin Machine Co., New York.
Niles-Bement-Pond Co., New York.

Smokestacks.
Plessisville Foundry, Plessisville, Que.
Polson Iron Works, Toronto.

Sockets.
Brown & Sharpe Mfg. Co., Providence, R.I.
Cleveland Twist Drill Co., Cleveland.
Keystone Mfg. Co., Buffalo, N.Y.
Modern Tool Co., Erie, Pa.
Morse Twist Drill & Machine Co., New Bedford
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.
Wharton & Barnes Mfg. Co., St Catharines, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Soldering Irons.
Brown Boggs & Co., Hamilton, Can.

Solders.
Tallman Brass & Metal Co., Hamilton.

Special Machinery.
Armstrong Bros., Toronto.
W. H. Banfield & Sons, Toronto.
John Bertram & Sons Co., Dundas.
Baird Machine Co., Bridgeport, Conn
Bliss, E. W., Co., Brooklyn, N.Y.
Brown, Boggs & Co., Hamilton, Can.
Can. Fairbanks-Morse Co., Montreal.
Canada Machine Screw Co., Montreal
Cunningham & Sons, St. Catharines, Ont.
Charles F. Elmes Eng. Works, Chicago
Detrick & Harvey Machine Co., Baltimore, Md.
Ford-Smith Machine Co., Hamilton.
Garvin Machine Co., New York.
Gooley & Edlund, Inc., Courtland, N.Y.
John H. Hall & Sons, Brantford.
Jardine, A. B., & Co., Hespeler.
National Mach. & Sup. Co., Hamilton.
Plessisville Foundry, Plessisville, Que.
Smart-Turner Machine Co., Hamilton, Ont.
Wm. Tod Company, Youngstown, O.

Spike Machines.
The Smart-Turner Machine Co., Hamilton.

Spring Coilers.
Baird Machine Co., Bridgeport, Conn.
Garvin Machine Co., New York.

Springs, Machinery.
Cleveland Wire Spring Co., Cleveland.
Jas. Steele, Ltd., Guelph, Ont.

Spring Making Machinery (Automatic).
Baird Machine Co., Bridgeport, Conn.

Sprockets, Chain.
Morse Chain Co., Ithaca, N.Y.
Philadelphia Gear Works, Philadelphia, Pa.

Stairs, Iron.
Canada Wire & Iron Goods Co., Hamilton, Ont.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Stamping.
Duncan Electrical Co., Montreal.

Stamping Machinery.
Homer & Wilson, Hamilton, Ont.
Brown, Boggs & Co., Hamilton, Can.

Stay-Bolt Driver.
Independent Pneumatic Tool Co., Chicago.

Stand Pipes.
Polson Iron Works, Toronto.

Stationary Ladders.
New Britain Machine Co., New Britain, Conn.

Steam Specialties.
Sheldons, Ltd., Galt, Ont.

Steam Separators and Traps.
Can. Fairbanks-Morse Co., Montreal.
Can. Sirocco Co., Ltd., Windsor, Ont.
Sheldons, Ltd., Galt, Ont.
The Smart-Turner Machine Co., Hamilton.

Steel Alloy.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

Steel Chains for Pulp Mill and Saw Mill.
Plessisville Foundry, Plessisville, Que.

Steel Bench Legs.
New Britain Machine Co., New Britain, Conn.

Steel Bending Brakes.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Steel, Cold Rolled.
Can. Drawn Steel Co., Hamilton, Ont.
Union Drawn Steel Co., Hamilton, Ont.

Steel Pressure Blowers.
Can. Buffalo Forge Co., Montreal.
Can. Fairbanks-Morse Co., Montreal.
Sheldons, Ltd., Galt, Ont.

Steel, all kinds.
Can Bridge Co., Walkerville, Ont.

Steel, High Speed.
Armstrong Whitworth of Canada, Ltd., Montreal.
Can. Fairbanks-Morse Co., Montreal.
H. A. Drury Co., Ltd., Montreal.
Thos. Firth & Sons, Montreal.
National Mach. & Sup. Co., Hamilton.
Vanadium Alloys Steel Co., Pittsburg, Pa.

Steel Die Engraving.
Noble & Westbrook Mfg. Co., Hartford, Conn.

Steel Vanadium.
Vanadium Alloys Steel Co., Pittsburgh, Pa.

Stocks for Dies.
Wells Bros. Co., Greenfield, Mass.

Stocks, Pipe.
Butterfield & Co., Rock Island, Que.
Greenfield Tap & Die Corporation, Greenfield, Mass.

Stools, Steel, Shop.
Dennis Wire & Iron Works Co., Ltd., London, Canada.

Stock Racks for Bars, Piping, Etc.
New Britain Machine Co., New Britain, Conn.

Straight Edges.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Straightening Machinery.
Baird Machine Co., Bridgeport, Conn.
Bertrams, Ltd., Edinburgh, Scotland
National Mach. & Sup. Co., Hamilton.

Structural Steel.
Hamilton Bridge Works Co., Hamilton, Ont.
Owen Sound Iron Works Co., Owen Sound, Ont.

Studs.
Galt Machine Screw Co., Galt, Ont.
John Morrow Screw Co., Ingersoll, Ont.

Stud Driver.
Keystone Mfg. Co., Buffalo, N.Y.

Switchboards.
Toronto & Hamilton Electric Co., Hamilton.

Switches, Railway.
National Mach. & Sup. Co., Hamilton.

Tachometers.
Brown Instrument Co., Philadelphia, Pa.

Tanks, Oil.
Wayne Oil Tank & Pump Co., Fort Wayne, Ind.

Tanks, Steel.
John Inglis Co., Toronto.
Plessisville Foundry, Plessisville, Que
Polson Iron Works, Toronto.

Tapes, Measuring.
Lufkin Rule Co., Windsor, Ont.
James Chesterman & Co., Ltd., Sheffield, Eng.

Tapes, Friction.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Tapping Machines (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Independent Pneumatic Tool Co., Chicago, Ill.

Tapping Machines and Attachments.
Baker Brothers, Toledo, O.
John Bertram & Sons Co., Dundas.
Garvin Machine Co., New York.
The Geometric Tool Co., New Haven
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Tap & Die Corporation, Greenfield, Mass.
J. H. Hall & Sons, Brantford, Ont.
A. B. Jardine & Co., Hespeler.
Landis Machine Co., Waynesboro, Pa.
Manufacturers Equipment Co., Chicago, Ill.
Modern Tool Co., Erie, Pa.
Murchey Machine & Tool Co., Detroit
Niles-Bement-Pond Co., New York.
L. S. Starrett Co., Athol, Mass.

Tap Chucks.
Wells Bros., Greenfield, Mass.

Taps, Adjustable.
Geometric Tool Co., New Haven.
Manufacturers Equipment Co., Chicago, Ill.
Murchey Machine & Tool Co., Detroit.

Taps, Dies and Wrenches.
Butterfield & Co., Rock Island, Que.
Can. Fairbanks-Morse Co., Montreal.
Can. Tap & Die Co., Galt, Ont.
Cleveland Twist Drill Co., Cleveland
Geometric Tool Co., New Haven, Conn.
A. B. Jardine & Co., Hespeler.
Morse Twist Drill & Machine Co., New Bedford.
Murchey Machine & Tool Co., Detroit.
Pratt & Whitney Co., Dundas, Ont.
L. S. Starrett Co., Athol, Mass.
Wiley & Russell Co., Greenfield, Mass.
Wells Brothers Co., Greenfield, Mass.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Technical Books.
The MacLean Publishing Co., Ltd., Toronto.

Testing Instruments, Metallurgical.
Shore Instrument & Mfg. Co., New York City.

Testing Laboratories.
Toronto Testing Laboratory, Toronto.

Thread Cutting Machines.
Can. Fairbanks-Morse Co., Montreal.
Garvin Machine Co., New York.
Geometric Tool Co., New Haven, Conn.
Girard Machine & Tool Co., Philadelphia, Pa.
Greenfield Tap & Die Corporation, Greenfield, Mass.
Landis Machine Co., Waynesboro, Pa.
Pratt & Whitney Co., Dundas, Ont.
National Machy. Co., Tiffin, Ohio.
Wiley & Russell Co., Greenfield, Mass.

Thread Milling Machines.
Holden-Morgan Co., Toronto.

Thermometers, Indicating and Recording.
Brown Instrument Co., Philadelphia, Pa.

Time Clocks.
International Time Recording Co Toronto.

Tinsmiths' Tools.
Brown, Boggs & Co., Hamilton, Can.
Steel Bending Brake Works, Ltd., Chatham, Ont.

Tire Setting Machines, Hydraulic.
West Tire Setter Co., Rochester, N.Y.

Tire, Wheels.
Wells Bros. Co., Greenfield, Mass.

Toolmakers' Files.
American Swiss File & Tool Co., New York.

Tool Boxes, Steel.
Can. Steel Products Co., Montreal.

Tool Holders.
Armstrong Bros. Tool Co., Chicago.
Cleveland Twist Drill Co., Cleveland.
Modern Tool Co., Erie, Pa.
Pratt & Whitney Co., Dundas, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Tool Room Partitions.
Can. Wire & Iron Goods Co., Hamilton.

Tool Posts, Lathe.
Armstrong Bros. Tool Co., Chicago.

Tool Steel.
Armstrong, Whitworth, Ltd., of Canada, Montreal.
Can. Fairbanks-Morse Co., Montreal.
Thos. Firth & Sons, Montreal.
National Mach. & Sup. Co., Hamilton.

Tools, Blacksmiths', Etc.
A. R. Williams Machy. Co., Toronto.

Tools, Electrical.
A. R. Williams Machy. Co., Toronto.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
United States Elec. Tool Co., Cincinnati, O.

Tools, Grinding, Milling, Drilling, Etc.
Newton Machine Tool Works, Inc., Philadelphia, Pa.

Tools, Lathe, Planer and Slotter.
Armstrong Bros. Tool Co., Chicago.

Torches, Steel.
Stevens, F. B., Detroit, Mich.
Armstrong, Whitworth of Canada, Ltd., Montreal.

Track Bits.
Wilt Twist Drill Co. of Canada, Ltd., Walkerville, Ont.

Track Systems.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Track Tools.
Can. H. W. Johns-Manville Co., Ltd., Toronto.
Can. Fairbanks-Morse Co., Montreal.

Transformers and Converters.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Toronto & Hamilton Electric Co., Hamilton, Ont.

Transmission Machinery.
A. R. Williams Machy. Co., Toronto.
Can. Fairbanks-Morse Co., Montreal.
Can. Drawn Steel Co., Hamilton, Ont.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Hamilton Gear & Mach. Co., Toronto.
Jones & Glassco, Montreal.
D. K. McLaren, Montreal.
Morse Chain Co., Ithaca, N.Y.
Plessisville Foundry, Plessisville, Que.
The Smart-Turner Machine Co., Hamilton.

Transmission Towers.
Can. Bridge Co., Walkerville, Ont.
Canadian Ingersoll-Rand Co., Ltd., Montreal.
Curtis Pneumatic Machinery Co., St. Louis, Mo.
Northern Crane Works, Walkerville.
Tallman Brass & Metal Co., Hamilton.

Traveling Cranes.
Herbert Morris Crane & Hoist Co., Ltd., Toronto.
Northern Crane Works, Walkerville.
Smart-Turner Machine Co., Hamilton, Ont.
Whiting Foundry Equipment Co., Harvey, Ill.

Trolley Hoists, Electric.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Trucks, Lumber and Kiln.
Shelbens, Ltd., Galt, Ont.
Northern Crane Works, Walkerville.

Trucks, Factory, Freight, Etc.
Chambers, Ltd., Toronto.
Canada Crucible, Pipe & Foundry Co., Toronto.
Toronto Type Foundry Co., Toronto.
Whiting Foundry Equipment Co., Harvey, Ill.

Tube Expanders (Rollers).
A. R. Jardine & Co., Hespeler.
Watson-Stillman Co., Aldene, N.J.

Tumbling Barrels.
Baird Machine Co., Bridgeport, Conn.
Northern Crane Works, Walkerville.
Whiting Foundry Equipment Co., Harvey, Ill.

Turnbuckles.
Canadian Billings & Spencer, Ltd., Welland.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Turret Machines.
Acme Machine Tool Co., Cincinnati, O.
Brown & Sharpe Mfg. Co., Providence, R.I.
W. P. Davis Machine Co., Rochester, N.Y.
Fay & Scott, Dexter, Me.
Girard Machine & Tool Co., Philadelphia, Pa.
Hill, Clarke & Co. of Chicago, Chicago, Ill.
Motch & Merryweather Machy. Co., Cleveland, O.

Valves, Hydraulic.
Can. Boomer & Boschert Press Co., Montreal.
Charles F. Elmes Eng. Works, Chicago, Ill.
Watson-Stillman Co., Aldene, N.J.
R. D. Wood & Co., Philadelphia, Pa.

Valve Leathers.
Graton & Knight Mfg. Co., Montreal.

Valves, Back Pressure, Steam.
Sheldons, Limited, Galt.

Vanadium Steel.
H. A. Drury Co., Ltd., Montreal.

Ventilating Apparatus.
Can. Sirocco Co., Ltd., Windsor, Ont.
Pangborn Corporation, Hagerstown, Md.
Sheldons, Limited, Galt.
A. R. Williams Machy. Co., Toronto.

Vises, Bench.
Emmert Mfg. Co., Waynesboro, Pa.
Hollands Mfg. Co., Erie, Pa.

New Britain Machine Co., New Britain, Conn.
Pratt & Whitney, Hartford, Conn.
Turner Machine Co., Ltd., Danbury, Conn.
Warner & Swasey, Cleveland, O.

Turbines, Steam, Water.
Plessisville Foundry, Plessisville, Que.

Upsetting and Bending Machinery.
A. R. Williams Machy. Co., Toronto.
John Bertram & Sons Co., Dundas.
Brown, Boggs Co., Ltd., Hamilton, Canada.
A. R. Jardine & Co., Hespeler.
National Machy. Co., Tiffin, O.
Niles-Bement-Pond Co., New York.
Watson-Stillman Co., Aldene, N.J.

Vacuum Pumps.
Buffalo Forge Co., Buffalo, N.Y.
Smart-Turner Machine Co., Hamilton, Ont.

Valve Grinders (Pneumatic).
Cleveland Pneumatic Tool Co. of Canada, Toronto.
National Mach. & Sup. Co., Hamilton.
New Britain Machine Co., New Britain, Conn.

Vises, Pipe.
Armstrong Mfg. Company, Bridgeport, Conn.
Bignell & Kesler Mach. Works, Edwardsville, Ill.
Butterfield & Co., Rock Island, Que.
Emmert Mfg. Co., Waynesboro, Pa.
National Mach. & Sup. Co., Hamilton.
J. H. Williams Co., Brooklyn, N.Y.

Vises, Planer and Shaper.
Girard Machine & Tool Co., Philadelphia, Pa.
National Mach. & Sup. Co., Hamilton.
Skinner Chuck Co., New Britain, Ct.

Vises, Milling Machine.
National Mach. & Sup. Co., Hamilton.

Vises, Woodworking.
Emmert Mfg. Co., Waynesboro, Pa.

Voltmeters.
Brown Instrument Co., Philadelphia, Pa.

Washers.
Chicago Rawhide Mfg. Co., Chicago, Ill.
Graton & Knight Mfg. Co., Worcester, Mass.
London Bolt & Hinge Works, London, Ont.

Washer Machines.
National Machy. Co., Tiffin, Ohio.

Waterproof Coating, Cement, Fabric.
Can. H. W. Johns-Manville Co., Ltd., Toronto.

Watchman's Clocks.
A. R. Williams Machy. Co., Toronto.

Wattmeters.
Brown Instrument Co., Philadelphia, Pa.

Welding and Cutting Clamps.
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.

Welding and Cutting Work.
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.
Metals Welding Co., Cleveland, O.

Welding, Autogenous.
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.

Welding, Acetylene and Oxygen
Can. Blaugas Co., Ltd., Montreal.
L'Air Liquide Society, Toronto.
Metals Welding Co., Cleveland, O.

Welding Machines, Electric, etc
Can. Blaugas Co., Ltd., Montreal.
Tabor Mfg. Co., Philadelphia, Pa.

Wheels, Emery, Carborundum.
Can. Hart Wheels, Ltd., Hamilton, Ont.
Dom. Abrasive Wheel Co., Toronto.

Winches.
John H. Hall & Sons, Brantford.
Northern Crane Works, Walkerville.

Window Wire Guards.
Canada Wire & Iron Goods Co., Hamilton.

Wire Cloth and Perforated Metals.
Canada Wire & Iron Goods Co., Hamilton.
Dennis Wire & Iron Works Co., Ltd. London.

Wire Forming and Stamping Machinery.
Brown, Boggs Co., Ltd., Hamilton Canada.
F. B. Shuster Co., New Haven, Conn.
Baird Machine Co., Bridgeport, Conn.

Wire Guards and Railings.
Canada Wire & Iron Goods Co., Hamilton, Ont.

Wire Nails.
Parmenter & Bulloch Co., Gananoque.

Wire Nail Machinery.
National Machy. Co., Tiffin, Ohio.
A. R. Williams Machy. Co., Toronto.

Wire Straighteners and Cutters.
Baird Machine Co., Bridgeport, Conn.
Brown, Boggs Co., Ltd., Hamilton Canada.
F. B. Shuster Co., New Haven, Conn.

Wire Coiling and Pointing Machines.
Baird Machine Co., Bridgeport, Conn.
F. B. Shuster Co., New Haven, Conn.

Wood Boring Machines.
Cleveland Pneumatic Tool Co. of Canada, Toronto.
Girard Machine & Tool Co., Philadelphia, Pa.
Independent Pneumatic Tool Co., Chicago, Ill.

Woodworking Machinery.
Buffalo Forge Co., Buffalo, N.Y.
Can. Fairbanks-Morse Co., Montreal.
Girard Machine & Tool Co., Philadelphia, Pa.
New Britain Machine Co., New Britain, Conn.
Plessisville Foundry, Plessisville, Que.
A. R. Williams Machy. Co., Toronto.

Wrenches.
Armstrong Bros. Tool Co., Chicago, Ill.
Butterfield & Co., Rock Island, Que.
Canadian Billings & Spencer, Ltd., Welland.
Keystone Mfg. Co., Buffalo, N.Y.
Wells Bros. Co., Greenfield, Mass.
Whitman & Barnes Mfg. Co., St. Catharines, Ont.
J. H. Williams Co., Brooklyn, N.Y.

Wrenches, Automobile Narrow Jaw and Monkey.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Pipe, Monkey.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Trimont Mfg. Co., Roxbury, Mass.

Wrenches, Ratchet and Basin.
Bemis & Call Hardware & Tool Co., Springfield, Mass.
Keystone Mfg. Co., Buffalo, N.Y.
Trimont Mfg. Co., Roxbury, Mass.

If what you want is not advertised in this issue consult the Buyers' Directory at the back.

INDEX TO ADVERTISERS

Late Arrivals!

Who Pays?

Are at least 5 late in every 100 employees? Yes, generally more! Do they average a minimum of five minutes late each? Yes, every time. Now, suppose you have 1,000 employees! Five in each 100 late, or 50 men late, averaging five minutes each, or **250 MINUTES—TWICE A DAY**, or five hundred minutes a day lost—**3,000 MINUTES A WEEK**—12,000 minutes a month—**200 HOURS** at an average of 30c per hour, **OR $60.00 A MONTH COMPLETE LOSS**, and that is not counting time lost by many more employees who quit five or more minutes early to wash up, etc.

You are paying for this waste time **if you are not** using the

INTERNATIONAL TIME RECORDING SYSTEM

Why do it? **LOOK AT THE INTEREST ON YOUR MONEY ALONE—WHAT BETTER INVESTMENT CAN YOU MAKE?**

Prices: Dial Clocks, $85.00 and up. Card Clocks, $95.00 and up, according to style and size.

International Time Recording System of Canada, Limited

RYRIE BUILDING, TORONTO, ONT.

BRANCHES:

315-316 Transportation Building, cor. St. James and St. Francis St., Montreal; 800 Sterling Bank Building, Winnipeg, Man.; 319 Pender Street West, Vancouver, B.C.

IF YOU WILL KINDLY FILL IN AND MAIL US THIS COUPON WE WILL GIVE YOU VERY CLOSE FIGURES ON THE ALL-ROUND SAVINGS THE INTERNATIONAL TIME RECORDING SYSTEM WILL EFFECT IN YOUR PLANT.

We can show you that it costs a great deal more to be without this system than to buy it.

The International Time Recording Company of Canada

Ryrie Bldg., Toronto, Cnt.

Number of Employees.....
What percentage female .....
Working Time Schedule—IN.....OUT.....
A.M. A.M.
P.M. P.M.
IN.....OUT.....
What is your pay period—WEEKLY.....
TWO-WEEKLY..... SEMI-MON.....
MONTHLY.....
Do employees work overtime? .....
If so, about what percentage? .....
Do you work night shifts? .....
If so, state time schedule? .....
How many entrances to plant? .....
How many different buildings? .....
What distance from entrance to farthest department? .....
Do you penalize employees for tardiness? .....
Who compiles the pay roll? .....
How many office employees? .....
What is your average hourly rate? .....

THE ABOVE INFORMATION WILL BE TREATED AS **STRICTLY CONFIDENTIAL.**

NAME.....

ADDRESS.....